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WORKING PLANS FOR PERMANENT FARMS

U. S. DEPARTMENT OF AGRICULTURE

MISCELLANEOUS PUBLICATION No. 411

Working Plans for Permanent Farms

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Soil Conservation Service, in Collaboration with Subject-Matter Specialists

Contents

	Page
The need for speed	1
Meshing the forces of repair	3
Remedies	5
Cooperative action	8
Making farm conservation plans	11
Finding the facts	11
The "capability" map	11
Economic considerations	13
The group approach	15
On the single farm	17
Three sample farms	20
The Hammett farm	20
The Blau farm	28
The Hass farm	35

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Erratum: In figure 7 change Tyler to Temple

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FIGURE 1.—Good land like this is becoming scarcer each year as wind and water lash unprotected acres. It constitutes less than one-fifth of the land area of the United States.

The Need for Speed

Good land is scarce in the United States. It is becoming scarcer each year as wind and water lash unprotected acres.

Our land body as a whole contains something over 1,900 million acres. But this figure is misleading. From the standpoint of cultivation we must count out the acres in forests and in range. We must also count out the mean, stony, infertile waste acres, the swampy acres, the acres that lie under lakes, rivers, cities, and the acres that have been abandoned because of overcropping, overgrazing, or erosion. When all of these are counted out we have left about 415 million acres of cultivable cropland.

Of this present cropland area, only about 342 million acres can be classed as really good (fig. 1). The remainder is too steep or too infertile for profitable cultivation. But we must not overlook the fact that the major portion of our good cropland is losing soil with every hard rain (fig. 2). Any one who has an eye for soil and who has ridden across the great stretches of our rolling cornland in the spring of the year cannot fail to notice how good land is being misused even though it is still productive.

Some of our land, of course, is so nearly level that erosion has little effect upon it, but we have only about 62 million acres now in crops that are both good and definitely nonerodible. By undertaking costly projects of irrigation, drainage, clearing, and the like, we could add about 68 million acres of good, nonerodible land. This would increase our area of cropland but it would still fall far short of promising security for the future unless we change our ways of using the soil that is now vulnerable to erosion.

Our developing conservation-consciousness, as it has found expression in governmental programs, dates from the administration of Theodore Roosevelt. At the White House conference of Governors in 1908, he said: "To skin and exhaust the earth will result in undermining the days of our children." The new-born Forest Service, then under the leadership of Gifford Pinchot, labored effectively to make the public realize the hazard of removing trees from steep slopes. The undeniable gully, which appeared after the removal of trees, shouted ruin to every passerby. Only within the last 10 years, however, have we come to appreciate fully the more subtle devastation of gently sloping cultivated land or overused range land, by sheet erosion.

The public programs developed since 1930 differ sharply from those of the previous decades. For years the chief emphasis was placed on research and educational programs. While these programs have been expanded in recent years, the main emphasis has been placed on action phases of conservation. These action phases are designed to fit the needs of a complete farm unit. In this way the resources and facilities of the Government may be brought to bear on each acre of land. These action programs now find expression through soil conservation districts, watershed demonstration areas, community and county planning committees, rural zoning groups, isolated demonstrational farms, Agricultural Adjustment Administration provisions, and other democratic devices of recent origin.

Through the combined effort of landowners and help from governmental agencies, we have made more progress in erecting soil-saving safeguards within the last 7 years than at any previous time in our history. By February 1940 there were 94,673 farms in the United States upon which rather complete measures of control were established on 24,754,946 acres. This land lies in areas served by the Soil Conservation Service either through a project, a conservation district, or the work area of a Civilian Conservation Corps camp. During the last 3 years 234 soil conservation districts were organized by

farmers. These districts involved around 128 million acres in 28 States. Active work had been started in 171 of these districts which exceed 94 million acres. Moreover, enabling legislation had been passed in 36 of the 48 States and over 100 additional districts were in various stages of formation.

the A. A. A. These programs help the farmer meet the costs of shifting from an exploitative system of agriculture to a conservation system. In 1939 at least three-fourths of all the farm families in the United States took part.

Other Federal agencies, some within and some outside the Department of Agriculture, have

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FIGURE 2.—Much of our best land is losing soil with each hard rain.

Roughly, a third of the farmers who received loans from the Farm Security Administration in 1939 were practicing some definite erosion-control measures. Since most of these farmers are on lands lying outside of the demonstration areas of the Soil Conservation Service, there is little duplication in the two lists.

Bulking even larger, from the standpoint of the number of farms, is the work being done by

helped to speed up the use of improved practices on the land. Despite all of this hopeful activity we must face the fact that we are not yet adequately coping with the problem. "Land is still wearing out faster than we are able to restore it" said Secretary Wallace in his address before the Land Grant College Association in Washington, November 1939. The Secretary added: "We cannot even begin to breathe easy until the

forces of destruction are at least balanced by the forces of repair."

Meshing the Forces of Repair

The most difficult thing, and the most necessary, in the light of the present urgency, is to see that the forces of repair mesh into a unified, sensible program, and move forward effectively together. While we are not yet moving fast enough in developing safeguards for soil resources, we should not, in our zeal for speed, fail to evaluate the lessons of experience.

Experience in recent years reinforces the belief that *single measures* of soil-saving strategy are usually inadequate. When watershed demonstration areas were established in the middle 1930's, the plans on farms were made with the firm idea that only a coordinated attack using every appropriate weapon would suffice. The plans represent the combined judgment of the engineer, the agronomist, the biologist, the soil specialist, and the farm-management specialist. Each farm plan calls for an appropriate blend of control measures and practices for a specific farm. Soil conservationists, for the first time, approached their task in much the same way that the modern general practitioner diagnoses human ailments.

The problems connected with the soil, of course, are usually not so complex nor are the cures so intricate as those of the human body. Yet the modern approach to the problems and the methods of determining the cures strike a surprising parallel. Further, soil problems, like human ailments, cannot be successfully treated by panaceas.

History sustains this view. When single intertilled crops permitted rain to etch gullies on the early-day Atlantic coastal farms, it was the gully plug that was used as the first hasty technique of control. George Washington, along with other early-day farmers, failed to halt the growth of gullies. Thomas Jefferson tried horizontal plowing and failed. Later, and after cotton marched westward across the South, it was the terrace upon which many farmers placed their chief reliance, but terracing in itself proved inadequate. Of course, with our modern equipment and our more advanced knowledge we can now do a far better job of stabilizing gullies, and we can strike contour lines more precisely and more easily than our forefathers could. And we can now build terraces that are far stronger than those of the early day. Yet despite all this we are still retreating from the use of single methods to hold soil.

Comparatively recent experience on the Great Plains, where large areas of land came under the plow during the present century, emphasizes the inadequacy of any one measure of defense against the wind. One example will suffice: Strip cropping, in parallel bands and irrespective of slope, has been employed in some areas as a solution to the soil-drifting problem. Unquestionably this practice has some value. However, since the strips were not on the contour, the farmers failed to get the benefit of the additional moisture which strips on the contour might have provided. Moisture conservation is essential to insure vegetation on the Plains. With meager vegetation there can be no adequate defense against the wind.

This idea of using a combination of defense measures is taking hold. R. Y. Bailey, agronomist for the Soil Conservation Service in the Southeast, said:

> Those who think that I am a bit "touched" on the subject of kudzu and other perennial forage crops should have been around when I was trying to get hairy vetch established in a hill county down in Alabama where I was county agent from 1923 to 1927. I really carried the torch for hairy vetch. I attempted to build my entire soil-building program around hairy vetch and terracing. Since that time, however, a new philosophy has been developed in agriculture. Instead of staking everything on one crop or mechanical measure, we are bringing several useful crops and mechanical measures together into a complete, coordinated program designed to use every portion of the farm and to conserve it for future use. Just as a winning team must have capable players in all positions, so an effective conservation program must have proper balance and coordination between different kinds of vegetation along with necessary mechanical measures

All this adds up to the fact that no sweeping and rigid prescription for land ailments will do. The success of one practice depends upon another. Mechanical measures frequently fail if not supported by proper vegetal safeguards. And vegetation frequently fails when mechanical aids are ill-suited or inadequate. Moreover, every farm is a different piece of land. Every farmer differs from his neighbors. Each farm calls for individual treatment. And to treat certain fields and neglect others is frequently little better than no treatment at all. The whole answer as we begin to understand it now, lies in no one defense; it involves a changed design of land use, an astute combination of cultural tactics, a whole new pattern of agriculture (fig. 3).

Our ultimate success in putting the land in better working order will require more than a new philosophy, more than knowledge to guide our efforts constructively, more than our realization of the need for action, more than governmental programs. All of these are needed, but to succeed we must get wide application of desirable land use adjustments and farming practices on the individual acres of the individual farms throughout the country.

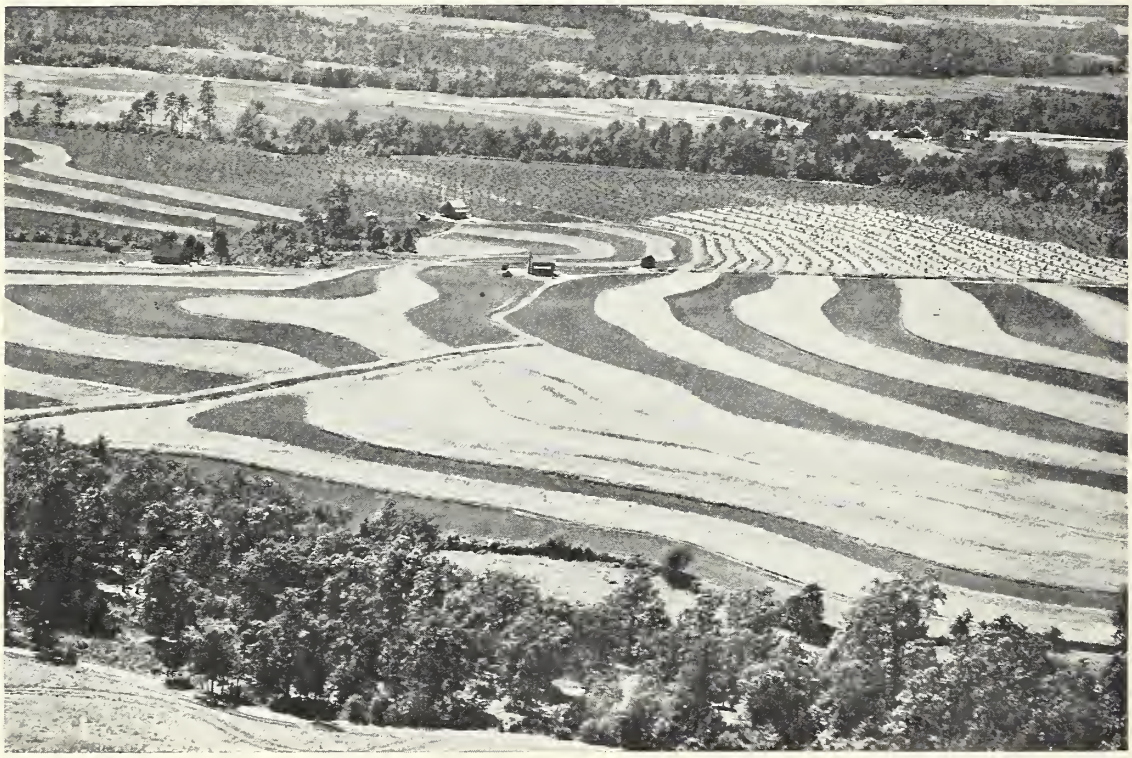

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FIGURE 3.—A new way of using the land. Whole fields are not planted to a single crop. Cotton still grows on this South Carolina farm but it is now planted in strips that follow the contour of the land. Each cultivated strip is protected from washing by terraces and strips of small grain. Annual lespedeza follows the small grain. The extensive peach orchard in the middle background is planted on the contour.

Remedies

It is impossible to set down in one-two-three order the precise remedies that a farmer, or one who advises the farmer, should employ in developing defense measures for a farm. The working combination of defenses that will do the job for a Maine potato farm will not serve on the wheatlands of the Plains, the citrus belts of California or Florida, nor probably in any other locality in the country.

While there is no one remedy or a combination of remedies that is everywhere good, there are some fundamental principles that have widespread application. There is a growing recognition that a wider use of close-growing grasses and legumes such as alfalfa, lespedeza, and the clovers proves effective over a wide range of soils (fig. 4). Apart from certain areas in the tropics, and some alluvial spots of comparatively minor extent, world experience indicates that most soils must have the perioidc benefit of close-growing grasses to maintain fertility and structure. To hold some soils one is obliged to grow these crops almost entirely. Other soils, on gentle slopes, may be devoted to intertilled crops grown in long rotations with grasses. There is ample evidence that the soils of the United States will rarely, if ever, retain their productivity if intertilled crops are grown year after year. Crop rotations, which include the grasses and legumes, may have to be supplemented with the turning under of leguminous crops and other devices to maintain an adequate supply of organic matter.

It has been estimated that, in terms of plant food (nitrogen, phosphorus, and potassium) the annual losses on many sloping fields are over 60 times as much through soil removal as is replaced through commercial fertilizers. It is necessary, therefore, on many soils to purchase more fertilizer than has been customary in order to maintain a vigorous plant cover. One of the meanest ironies of farming is the fact that the more the soil washes the less chance one has of growing crops to prevent its washing.

But all of the devices heretofore mentioned—the use of grass and legumes, improved rotations, chemical fertilizers, and lime—will not suffice on many farms to prevent a damaging amount of soil and water loss. Something more is needed.

What we need most of all is to get away from "square farming in a round country." Most of our fields and rotations must be reformed into strip-patterns laid out on the contour of the land. The new pattern is as individual to a given stretch of country as a fingerprint is to a man. It fits the land much as a well-tailored garment clings to the human body. Under this system each furrow and harrow groove serves as an impediment to run-off. Vegetation growing on the contour does the same. But perhaps most important, the right crop is grown in the right place: Trees on the crests and steeper slopes; grass on the shoulders; and cultivated crops on the more level areas.

While some such design is needed it does not follow that a farmer should neglect any of the practices that have been proved sound on his farm. The good farmer will continue to use all of these but he will also add, now that the need is apparent, whatever soil- and moisture-saving devices are appropriate for his land. He will incorporate the ordinary methods of conservation into the normal flow of work on his farm. If cover crops are needed, he will plant them each fall as a part of the season's program. In other words, when he rearranges his farm to conform to the lay of the land, and when he includes conservation measures, he is simply including good farming practices along with those which he has been following.

Physical adjustments when appropriately applied to the land may be counted on to reverse trends of depletion and bring about soil and

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FIGURE 4.—Most soils must have the periodic benefit of close-growing grasses and legumes to maintain fertility and other desirable soil conditions. This is a bromegrass pasture in Iowa.

moisture conservation. But these improvements alone cannot be obtained unless they are accompanied by social and economic adjustments. Tax adjustments are needed in many agricultural areas, and during the past 25 years it has been almost impossible for farmers as a whole to use conserving practices with the prevailing instability of farm prices. Then, too, many farmers cannot find the credit necessary to make a change from, say, an exploitative system of cash crops to a system that includes legumes and grasses for livestock.

One of the worst evils of the tenancy situation is the insecurity of tenure which usually prevails. Good management practices cannot be expected in the absence of continuity of tenure. Tenants have little incentive to adopt practices that will lower their immediate incomes even though such practices would return greater incomes over a period of years (fig. 5).

One of the most difficult economic problems in our western Plains country, for owners and tenants alike, stems from the small tracts of land which were originally granted by the Government through the various homestead laws. Legislators from the humid East were slow to realize that a 160-, a 320-, or even a 640-acre tract of land was far too small to provide a fair living for a family in many areas of the West where the rainfall is sparse. Thousands upon thousands of farm families have been forced to leave, others remain under precarious difficulties because their cramped holdings impose a type of agriculture that is out of harmony with the climate and the soil.

Although social and economic adjustments may appear as necessary indirect aids in preserving soil resources, it does not follow that when these adjustments are made a large proportion of farmers will improve their ways in

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FIGURE 5.—Insecurity of tenure is not conducive to the best use of the land. *Courtesy Farm Security Administration.*

using the land. Our experience and attitudes toward the use of land do not justify any such sweeping conclusion. When prices for corn and oats are high, for example, will any considerable proportion of the farmers buy clover seed and lime to rebuild their worn acres? Or, to ask the same question in another way, will farmers permit the favorable prices to lure them into an expansion of crops that pay the most at the moment? Apply the same question to the range country: Will high prices for meat on the hoof cause stockmen to graze their land more cautiously? Or will high prices induce them to overload the range and crop the grass dangerously close? Similar questions could be applied in numerous areas throughout the country, and the speed with which we are able to establish conservation practices depends, in the main, upon the way farmers react to their opportunities to make the necessary adjustments. All of these considerations suggest the need for a continuing educational program that will emphasize the necessity of protecting the soil resource.

The Congress has provided Federal help to farmers in dealing with such economic problems as the price of products, credit facilities, crop insurance, size of farms, and the transfer of farmers from poor land to better land. State governments also give assistance under a wide variety of State powers. All of which means that farmers and various arms of the Government are working together to effect economic improvements that will clear the way for physical adjustments that must be made to protect soil resources.

Granting that economic adjustments are under way or are such that it is possible to effect desirable physical changes on individual farms, the next logical step is a consideration of plans for an individual farm or ranch.

Cooperative Action

Since wind and water respect no county, State, or fence line, there can be no adequate conservation without the wholehearted understanding and backing of all the people who live on the land or benefit by its productivity (fig. 6). An individual can, of course, apply conservation measures upon his own land, but if he lives in a valley these measures do not protect his land against run-off from the farms that lie above. If the individual lives in a region where wind erosion is a problem he can do much to lash his own soil to earth with protective vegetation. But if the surrounding farms are left untreated, or abandoned, the wind will carry damaging quantities of soil onto his farm. If neighboring eroded farms fail to provide their share of taxes a heavier burden must be carried by the farms in good repair.

Apart from the necessity for the cooperation of neighboring farmers in establishing erosion-control practices, there is abundant evidence that safeguards can be established more economically through farmers working together. Cooperation among farmers in Wilson Hollow, a tributary of North Elm Creek near Temple, Tex., is a good example (fig. 7). Five years ago farmers and technicians of the Soil Conservation Service agreed to lay out controls along natural rather than artificial lines. Today these measures are effectively holding soil and water on 165 adjoining farms that cover 30,000 acres. It is the largest contiguous area of conservation-treated farm land in the country. If you climb to a high point in the watershed you can see safeguarded fields extending in an unbroken pattern as far as the eye can reach. Terraces

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FIGURE 6.—Soil protection is a problem for each farmer. But the individual, acting alone, cannot provide adequate safeguards without cooperation from his neighbors and the general public.

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FIGURE 7.—An air-view near Tyler, Tex. The new pattern of landscape design covers 165 adjoining farms.

cross the line fences of two, three, and, in some cases, a half dozen farms. Strips of cotton hug the contour across the slopes. Between the cotton strips are strips of small grain, sorghum, Hubam clover, and bluestem grasses. Every acre has been treated.

By building terraces across farm boundaries, a large number of terrace outlets were eliminated that would have been necessary if each farm had been treated as a separate unit without considering the needs of adjacent land. In the solid block of treated farms there are 42 cooperative terrace outlets serving exactly 100 farms. Most of these drain water from 2 adjacent farms. But 8 of them serve 3 farms each; 1 handles water from 5 farms; and 1 big channel provides for the safe disposal of water from 6 separate farms.

Tallapoosa County, Ala., provides another example of the benefits of group action. Elmer Rowalt in his bulletin, Soil Defense in the Piedmont, written in 1936, said:

> Tallapoosa County is one of the more severely eroded areas in Alabama. When the county hired Fletcher Farrington as agricultural agent in 1932, there was hardly a cultivable terrace in the county. The homemade terraces, thrown up by a plow drawn by a thin mule or two, were breaking under the stress of heavy rains that in a single year poured several hundred thou-

sand gallons of water on each acre. Farrington helped to organize a terracing club, and in 3 years the club terraced 50,000 acres of land. At the beginning of 1936 six terracing units were at work daily, weather permitting, throwing up broad-base terraces on eroding slopes. As soon as the farmers terraced a field they planted hairy vetch, Austrian Winter peas, or crimson clover. Bringing legumes into the rotation and holding the soil and water by terracing boosted yields of corn in the short space of 3 years from 6 to 26 bushels an acre. Farmers in Tallapoosa County called 1935 their best season in 35 years.

In this present year, 1940, farmers cooperatively operate 10 terracing units in the county, and Mr. Farrington reports that the average cost is about $3.50 per operating hour.

Making Farm Conservation Plans

Finding the Facts

Through years of research and experience we have accumulated a vast array of facts about our soils. But we know now that we need far more facts than were once thought necessary. We are beginning to see that land use reaches beyond a consideration of a soil profile, as important as that is. We now know that proper land use is determined in part by slope, temperature, sunshine, rain, and snow, along with other factors, in a complex interlocking combination. We should not consider some facts and ignore others that are significant.

When the watershed project demonstration areas were established in numerous areas throughout the country, one of the first steps was to determine the significant physical facts. Many of these physical facts were recorded on a map of the area. These facts included the soil type, the steepness of the slopes, the extent of erosion, and the present land use. Other important facts which could not be shown on a map without making it too complicated for practical use, were set down, in some detail, in the survey report of the area. These facts included the character of the rainfall, the normal frost-free days of the season, the wind velocities (in some regions), the water-absorbing and water-holding capacity of the soil, and other physical factors that have a bearing on land use and the application of control measures. This method of physical fact finding was evolved through the experience of technicians on the job. But from the very first an effort has been made toward simplification. The most significant advance to date has been the making and use of a new type of map.

The "Capability" Map

The word "capability" suggests that this new map is not a soils map, a rainfall, topographic, or land-classification map as usually defined. In a sense it is an interpretation of the pertinent physical facts about a given piece of land as these facts relate to its practical use. It meets the need for simplifying complicated survey data by grouping numerous technical separations into a small number of general classes which adequately express the principal kinds of adaptable land use. It contains the essential physical information generally needed for the intelligent preparation of farm conservation plans. Consulting one of these maps, one can pick out the areas on a farm where simple erosion control is needed, those that need rather intensive treatment, and those on which intertilled crops can only occasionally be risked. Stated in very simple terms, the map may be compared to a system of traffic lights. Certain colors tell you to proceed, others tell you to go on, but cautiously, and still others tell you to stop.

Ordinarily, the farmer is not interested in the descriptive detail of the soil types on his farm, or an elaboration of the different classes of erosion. He wants to know what land he can cultivate to obtain a satisfactory yield and the measures needed to maintain the soil for permanent use. He wants to know what land should be in grass or trees and how to manage it to obtain the best returns. The range man, likewise, it primarily concerned about how he can make the best use of the various areas on his range. While these new maps classify the land in terms of land use capability they do not attempt to establish methods for applying the practices, measures, and treatments that may be required in any capability class. But the maps do reveal the physical information necessary for efficient guidance of programs of erosion control, water conservation, and land use readjustments.

The following land-capability classes have been established by the Department of Agriculture:

I. Suitable for cultivation without special practices.

II. Suitable for cultivation with simple practices.

III. Suitable for cultivation with complex or intensive practices.

IV. Not suitable for continuous cultivation.

V. Not suitable for cultivation; suitable for permanent vegetation without special practices.

VI. Not suitable for cultivation; moderately susceptible to deterioration, requiring moderate restrictions in use with or without special practices.

VII. Not suitable for cultivation; highly susceptible to deterioration, requiring severe restrictions in use with or without special practices.

VIII. Not suitable for cultivation or for the production of permanent vegetation.

It will be noted that these various classes are characterized on the basis of "hazard of use" and "limitations of tillage." The term "special practices" may have a different meaning in various regions of the country. To the Aroostook potato grower, the use of crop rotations, lime, and fertilizer probably would be considered as ordinary practices. On the other hand, contour tillage, strip cropping, and terracing would be considered as special practices. But to some farmers in the western edge of the Corn Belt where rolling land has been planted to corn or to corn and oats, year after year, for a decade or even longer, the use of lime, fertilizer, and crop rotations might be interpreted as special practices. There should be no confusion on this point so long as one keeps the needs of the land in mind.

Class I. Lands that can be cultivated permanently and safely with the production of moderate to high yields of adapted farm crops without the need of special practices or treatments.

Land in this class will have the following characteristics: (1) Cultivation is not impeded by stones, rock ledges, a permanently high water table, or any other condition that would seriously interfere with the use of machinery for tillage, (2) such intertilled crops as corn, cotton, or potatoes can be grown without serious soil losses, (3) it retains enough moisture and plant nutrients to favor the continued production of moderate to high yields of adapted crops. Though lands in this class will not need special practices or treatments, it is assumed that the commonly recognized good farming methods for the region will be used.

Class II. Land in this class requires one or more special practices if it is to be cultivated with safety. These special practices may include contour tillage, strip cropping, the removal of stones that interfere with cultivation, underdrainage, or any other practice that may be appropriate for a given piece of land.

Class III. To cultivate land in this classification with safety and permanence one must provide rather complex and intensive control measures if moderate to high yields are obtained. This land requires a higher degree of skill in management than that of class II. In the hands of one who can skillfully select and apply the appropriate measures of defense this land may be cultivated permanently.

Class IV. Land in this class is not suitable for regular tillage if one expects to obtain moderate to high yields and preserve the soil. Steep slopes, severe erosion, stoniness, poor drainage, low productivity, any one or a combination of these physical obstacles may eliminate it for regular cultivation. One might grow an intertilled row crop occasionally if that seemed wise as a step toward the renewal of a stand of grass for permanent pasture. If the land is too steep to risk an occasional row crop it might be used for annual legumes or close-growing grains, provided that these crops give effective cover when it is most needed.

Classes V, VI, and VII apply to land that is not suitable for cultivation but may be suitable for trees or grass, depending upon the region. Land in class VIII is not suitable for any productive agricultural use. These lands (classes V to VIII inclusive) cannot be cultivated safely at any time; the traffic light says, "Stop!"

The classes, both those in use for cultivated land and those proposed for forest and grazing

land, may not be precisely comparable from area to area across the country but in general they will be in conformity with the general scheme. In each case the classes are defined in general terms, as they must be, and they are modified and sharpened to harmonize with local conditions.

Since the use of capability maps is comparatively new it should be emphasized that these classifications are not necessarily permanent. A field now correctly labeled as class II might be lowered into the class III category if it is misused over a short period of time, say 3 to 5 years. Again, as our technical knowledge is increased, we may logically expect improvement in measures to impede soil and water losses. When these measures are applied we could expect to place the land in a higher classification. In arid regions the availability of water for irrigation would make some shift in the classification.

Economic Considerations

The physical facts, determined by the land conservation survey, in a sense, are the raw materials with which the farm planner has to work. The use to which these materials are put depends, probably, as much upon economic considerations as upon physical capabilities. The real object is to use the physical resources in such a way that they will continue permanently to yield the best returns for the farmer and society (fig. 8).

For this permanent program it is essential that the farm planner have an inventory of economic

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FIGURE 8.—The real object in farm planning is to use the physical resources in a way that will provide the best returns for the farmer and society from a permanent point of view.

facts. He will want to know the acreage, production, and use of the various crops grown on the farm. He will want to know the kinds and numbers of livestock produced and the amount of labor and operating capital that is available for use. He will consider, also, distances to markets, ownership or tenure status, the tax load, and the cost of irrigation water if the farm is in a semiarid or arid area.

If the farmer has been keeping a farm record for a number of years it will prove useful. Economic surveys and studies by experiment stations and colleges of agriculture are especially helpful. In short, any economic information that is pertinent to the operation of the farm should be assembled before any definite decisions are made.

On many farms there is a choice of methods of equal merit that might be used in controlling erosion on a given field. The needs of the farmer would suggest the particular method. This given field, for example, might be used as (1) pasture, (2) meadow, (3) a long rotation with several years in hay, (4) a rotation of medium length using contour cultivation and buffer strips, or (5) a short rotation with terracing and strip cropping. If the farmer needs pasture, and other land on the farm is better suited to clean-tilled crops, he should probably put this field to pasture. If he does not need the pasture, it would probably be feasible to terrace the field and grow strip crops in a short rotation.

Trial and Error Procedure

With a clear-cut inventory of physical and economic information assembled the farm planner and farm operator are in a position to draw up a farm plan.

The task of drawing a plan may be simple if little change is needed in land use. If terracing and strip cropping are needed to hold the soil, these practices may be employed with little disturbance to the existing farm organization plan. On the other hand, if it seems wise to grow fewer intertilled crops and more close-growing crops, such a change would very likely throw the feeds for livestock off balance. If little or no livestock is kept, the question then arises about market outlets for the close-growing crops.

If a number of changes are needed in land use, as well as practices, the farm planner would select a combination of land use and practices which would hold soil. He would then estimate the quantities of products which might be assumed under the proposed plan. To test his judgment he would probably ask himself: What quantity and kinds of cash crops would be available for sale? How much feed would be available for livestock? Are the various feeds—grain, hay, and pasture—in proper proportion to feed needs of livestock? Will the farm support more or less livestock than formerly? Will feeding practices have to be changed? Is there barn room for additional feed and livestock? And finally, can the farm operator meet the labor and capital requirements?

If all these questions can be answered satisfactorily and with understanding, then there is promise that the proposed plan will be feasible. If not, further adjustments in the plan are necessary.

The particular questions that might be raised about a tentative farm plan would vary, of course, with the different regions of the country. Those suggested above might be raised about a plan for a Corn Belt farm. The questions would differ in the dairy areas of the Northeast; they would differ in the Cotton Belt; they would differ on the High Plains, and they would differ in the irrigated areas of the West; yet in principle such questions would help to "true up" and make a farm plan sound and workable.

One of the most difficult problems of planning for conservation and human welfare occurs on those farms where little fault can be found with the current economic returns. We have some farmers who still have a reserve of topsoil and whose returns are considered adequate for a fair standard of living if they get a fair break in prices. But their soil lies on slopes and each

year erosion reduces the margin of topsoil. The time will come, if damaging erosion continues, when production will taper off. Planning a farm program under such conditions usually resolves itself into a choice of high immediate returns for a short period or more modest returns over a period of years, thereby leaving the soil resource unimpaired. Once such farmers are convinced that they are losing topsoil faster than it is being restored, most of them usually take the longer view and plan their farms for continued productivity.

The Group Approach

The suggestions, here given, on farm planning have been developed through 6 years of experience in planning 100,000 farms scattered over the United States. The procedure, while subject to local variations to meet specific conditions, represents, in the main, the most efficient method that has been developed to date.

We will assume that a soil conservation district, project, or work area, has been organized, and that meetings have been held to acquaint farmers with the advantages of a conservation plan. We will also assume that surveys have been made and that maps have been prepared showing physical features of the land, and classes of land according to use capability.

After these preliminary steps have been taken, the technicians, as a group, together with experienced farmers, will prepare a detailed statement of recommendations for land use, soil treatment, and the supporting erosion-control measures for each of the land-capability classes established by the survey.

Usually, the next step is to schedule a series of group meetings which are called by, or in cooperation with, the county agricultural agent. One to four, or even more, meetings may be held in a single community (fig. 9).

The group leader usually brings an enlarged capability map of a typical farm of the area to the first meeting. He hangs this map where all can see and he explains the reasons for the different colors on the map. For example, the areas on the farm that are suitable for cultivation without special practices are colored yellow. Similarly, the technician explains the characteristics of each of the classes represented on the colored map.

In many areas the capability map of a single farm will not serve as a suitable example. Possibly there are very small farms along with very large farms within the area. There may be other reasons why more than one map should be used. If so, the group leader would try to have maps available to meet the varying conditions.

In most meetings a discussion of the use and practices for each capability class will probably consume the most time. The leader will discuss the recommendations and alternatives for land use, the proper soil treatments and erosion-control practices which have been established by cooperating technicians for the different land-capability classes. For example, a steep slope that is now in cultivation will be converted to permanent pasture or to woodland. If it is to be used as pasture, the discussion will hinge on ways and means of converting it to pasture, and its improvement as such. If this particular area is to go in trees the leader will discuss what species of trees would probably give the best results. Areas on the farm that are now in trees would probably remain in trees. But the leader would explain how the woodland could be used to give the highest returns. He would point out the necessity of excluding livestock, and the desirability of cutting some trees and letting others stand. He would emphasize the need for other well-recognized practices.

The cultivated land on this typical farm will probably have to be farmed on the contour. This will call for a radical change in field arrangement. Terracing may be necessary but in any event an appropriate cropping system and other cultural practices will have to be considered. Several combinations of cropping systems and supporting conservation practices are given for the various classes of land suitable for cultivation. Any one of these combinations may

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be satisfactory insofar as soil conservation is concerned. But the one chosen will depend primarily upon the needs and desires of the farmer.

These desires and needs of the farmer on this typical farm lead to a discussion of economic considerations. Costs of production, normal prices, and average yields of adapted crops over a long period of time would be considered. If this farm is in an area where the economic feasibility of certain crops is generally accepted, then little thought need be given to this particular question. However, there are areas, such as those along the border line between the Wheat Belt and grazing areas of the Great Plains, where considerable attention must be given to these factors.

To summarize, briefly, the group has examined the physical capabilities of the farm, they have considered changes in land use and farming practices, and they have debated the economic feasibility of their recommendations. But, of even more concern and interest to each farmer are the problems on his own farm. If he is convinced that the steps taken to analyze and solve the problems on the sample farm are sound he probably is ready to consider such a procedure for his own.

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FIGURE 9.—In many regions it is possible to hasten the making of farm plans through group meetings of neighboring farmers.

At this point each farmer is provided with a land-capability map of his own farm. He is also given a sheet containing the general recommendations for the treatment of land that falls in the various capability classes. Each farmer in the group will prepare as much of a plan as he is able and willing to prepare by using all of the materials and suggestions which have been discussed.

On the Single Farm

Some farmers will complete their own farm plan without further help from anyone. Most of them, however, will probably want further assistance (fig. 10). If so, the technician will set definite dates when he will appear at each of the farms where assistance is desired.

When the technician arrives at one of the farms he probably will find little use for a stereotyped formula on farm planning. A step-by-step procedure may appear practical but it certainly is not arbitrary or positive. To form and fit an erosion-control plan to a given farm is a job to be done there on the ground, with the lay of the land before you and with an intimate understanding of immediate circumstances. The technician's suggestions are influenced by the farmer's knowledge of his own land, its possibilities, its limitations, his own managerial ability, and his financial circumstances.

At the farm both the farmer and the technician will walk over every field. Together they discuss the feasibility of a change in crop rotations; they talk about the retirement of a steep slope that is now in cultivation to grass or trees; they note the natural waterways on the farm, and they discuss the management of the pastures and the woodland.

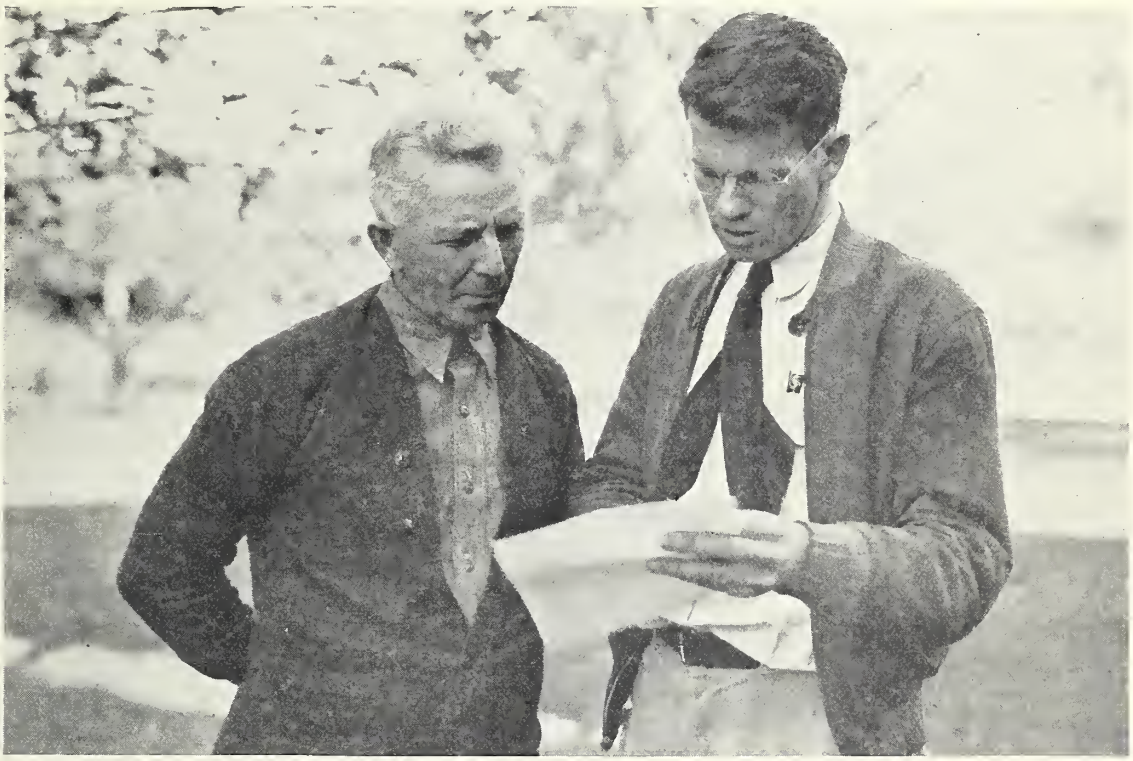

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FIGURE 10.—Most farmers have individual problems which cannot well be solved in group meetings. These problems are attacked on the farm.

If terracing seems to be needed they will look first of all to the possibility of developing suitable outlets. If terraces are not needed they will consider using wide grassed waterways in the natural drainage channels.

The farmer raises some very practical questions. If the whole farm is rearranged, he wants to

know how he can get his livestock to and from the pasture. One reason, he says, for keeping the comparatively level land near the barn in pasture is because of the water supply. He agrees that he is losing soil from a more distant sloping field each year that it is in corn, but how can it be devoted to pasture if no water is available? The planner may suggest running a wide lane back to it from the barn. In that way, he says, livestock can get to water, and the wide area will produce some feed. That may be a feasible solution to the water problem if the sloping field is retired to pasture. And when the water problem is solved the comparatively level area near the barn can be used for cultivated crops.

But other questions arise. The farmer wants to know how he can haul hay and grain from the strips that may extend a half or three-fourths the way around his farm. He wants to know how he can pasture his meadow strips when they are laid out in such a fashion. He sees some difficulty in running fences on the contour. Wire fences that follow contours are more difficult to build and maintain than fences that run in a straight line.

Many other questions, entirely too numerous to indicate here, will come up for discussion on every farm when the two individuals, the farmer and the experienced farm planner, seriously consider the problems involved. To some of the problems there may be no apparent solution, but experience indicates that a plan can usually be evolved on most farms that will meet the needs of the farmer and at the same time provide adequate conservation measures.

When they return to the house, they will probably sit down at the kitchen table, or on the porch if the weather is good, and set the plan down on paper. This whole procedure requires considerable discussion but in the end the farmer and the technician usually come to an agreement.

The completed farm plan usually consists of: (1) A capability map, (2) a land use map, (3) a plan of operations, (4) a job sheet sequence, and (5) an organization summary.

The land use map shows the permanent features of the farm. It includes the cultivated cropland, orchards, woodland, pasture lands, fences, buildings, roads, lanes, water facilities, water disposal, natural drainage channels, and a railroad, if one touches or cuts through the farm.

The plan of operations shows the land use and treatment for all of the land on the farm. The rotations, cultural methods, and supporting conservation practices are shown for all of the land under cultivation. It shows the crop rotation to be followed, the fertilizer to be applied, terraces to be constructed, and so on. Likewise, it shows how the woodland and pasture land should be handled to give the best returns. This plan of operations, of course, would vary from farm to farm. The farmer can follow only those things in the plan which are adjusted to meet his individual resources of time, finances, labor, and equipment. If, for example, he expects to use horse-drawn equipment in the construction of terraces, the specifications must be adapted to those tools.

The job sequence sheet shows the suggested order in which the various jobs should be attempted. If terraces are to be used in a certain field it is wise to construct outlets first and get them seeded well in advance of the time when water is turned in from the terrace channels. Occasionally it is necessary to construct new fences, or relocate old ones, before the cultivated land can be farmed on the contour.

Since the idea of a farm plan, either in one's head or on paper, is to incorporate the ordinary measures of conservation into the normal routine of farm work, it follows that a period of time will elapse before all of the improvements can be made. Some farmers may be able to make the suggested adjustments and changes in 2 or 3 years' time. Those who have little money or those with serious erosion problems, may not be able to attain their desired goal in 5 years or even longer.

The organization summary under normal conditions gives evidence of the practical soundness and earning possibilities of the program. This summary compares the new plan

with the old. It gives the acreage and estimated yields for the various crops. It gives the acreage of woodland. It records the number and kind of animals and shows the feed requirements that are based on the anticipated livestock.

After each farmer has been provided with a plan, which he himself has helped to devise, the group of farmers within the community will usually find it desirable to have a meeting. If they feel that they need additional technical help, such assistance can usually be obtained most advantageously through group action. If, for example, they need help in laying off strips for strip cropping or if they need assistance in determining the placement of terraces, or terrace outlets, this assistance can usually be given most efficiently if several farmers make the request. In some cases the farmers may wish to hire the labor and tractors to construct their terraces rather than attempt to build them with the power and equipment available on the farm. Some may wish to exchange labor, as they do in threshing or other jobs. Usually, matters of this kind can best be handled through a meeting of the interested farmers.

It is not expected that each farmer who has planned his farm in line with the suggestions given above will follow the plan in slavish detail. The plan is not so intended. Probably most plans will eventually be found back of the clock, or in some little-used bureau drawer. But if a farmer keeps his plan in some such place that does not mean it has not fulfilled the purpose for which it was intended. A well-conceived plan requires thinking and reasoning. Therein lies its chief value. The farmer knows his own soil best. He knows it from long association in working with it. Perhaps he does not need a map; the farm itself may be all the map he needs. After a farm is rearranged to conform to flow lines and each acre is devoted to its best use, even a cropping plan, on paper, may be unnecessary.

Three Sample Farms

Leaving now the discussion, which in general involves the principles, objectives, and procedure of farm planning, let us take a look at three widely separated farms that have been mapped and planned. One is in the Piedmont of the Southeast, another is on the High Plains of the Texas Panhandle, and the third lies near the Mississippi River, in southeastern Minnesota.

The Hammett Farm

The W. B. Hammett farm, in Spartanburg County, near Inman, S. C., contains 315 acres and it lies within the Broad River Soil Conservation District (fig. 11).

In this general area—high up in the old Piedmont—you will probably find more evidence of erosion-control devices than in any other large section of the country. For years, travelers by car and train have noticed the scarcity of straight rows and the numerous terrace embankments hugging the contour on sloping fields. Travelers have also noticed the numerous orchards laid out in contour rows around the hills rather than in the precise square and triangular patterns that

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FIGURE 11.—W. B. Hammett (left) and J. H. Tolbert scrutinize the "capability" map which provides some of the information leading to a revised farm plan.

FIGURE 12.—Cotton grown year after year on the same land accounts for the most severe soil losses on the Hammett farm.

are so common in most of the other fruit-growing regions of the country.

While most of these measures have been helpful, nevertheless soil and water losses have continued to mount and gullied fields are everywhere apparent. The answer, of course, lies principally in the fact that too large a proportion of the arable land has been cropped too long and too intensively in clean-tilled cotton. Years ago someone said that a cotton plant offers no more protection to the soil than a walking stick stuck in the ground. More recently a wry observer said that cotton stalks provide no more protection than quills without feathers would offer a hen.

Clean-tilled cotton is probably the chief cause of the soil troubles on the Hammett farm (fig. 12). For a number of reasons, these problems are probably not as serious as those on countless other farms in the Piedmont. One of the major reasons is that Cecil soils predominate on this farm. These soils are vulnerable to erosion under clean cultivation but they respond to good treatment far better than some of the other soils.

Mr. Hammett has given his soil better than average care. In recent years he has grown some cover crops or small grain after his clean-tilled cotton. These crops usually responded well since they received some benefit from the generous applications of commercial fertilizer, which was applied for cotton. Cover crops have also been grown in the 40-acre peach orchard, which is planted on the contour (fig. 13).

As helpful as cover crops and small grain have been in checking soil and water losses, these crops have been grown too sparsely and they have not

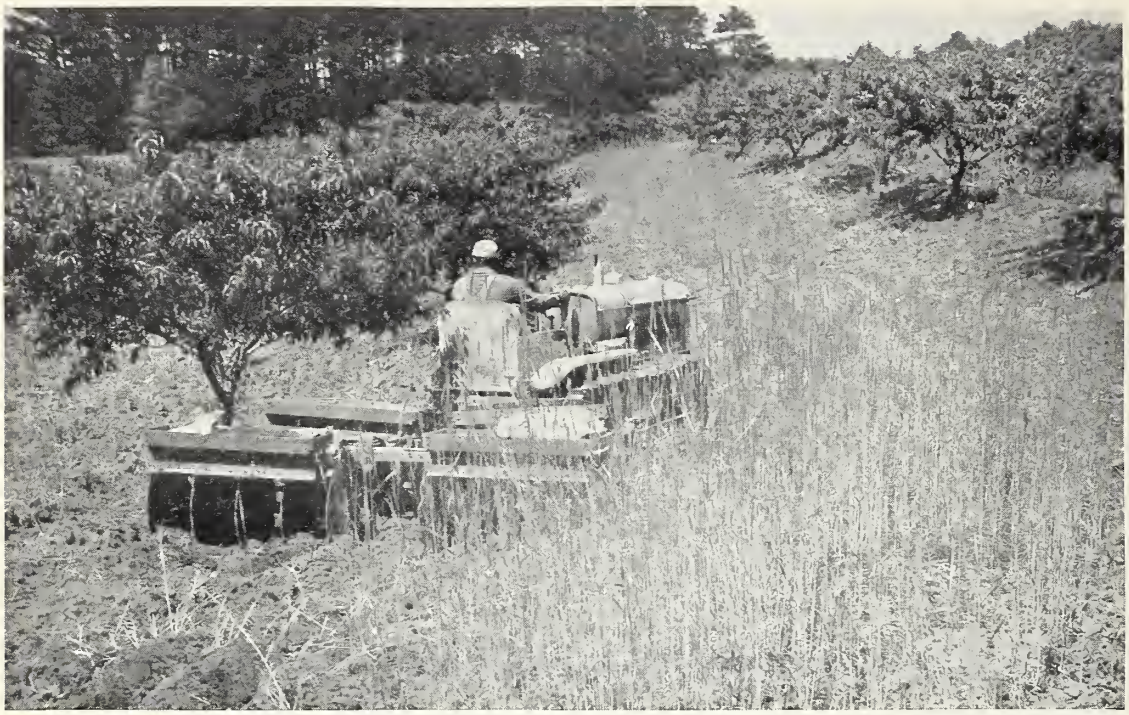

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FIGURE 13.—Cover crops are grown and turned under in the 40-acre peach orchard that is planted on the contour.

been knit into a regular cropping system for all of the cultivated land. Some of the cultivated fields have been terraced. But the terraces, without adequate support from close-growing crops, failed to keep the soil in place.

When soils men mapped this farm they found that the land in the best condition had lost between 25 and 50 percent of the original topsoil. Over most of the cultivated land the losses ranged between 50 and 75 percent. Each year gullies grew deeper and each year fewer and fewer of the older gullies could be crossed with machinery.

Before we discuss the proposed safeguards for the Hammett farm let us compare the way the land was used before the plan was made with the way it is to be used when the plan is completely in effect (table 1).

Prior to the time the new farm plan was made, Hammett was growing 55 acres of cotton, 35 acres of corn, 8 acres of oats, 25 acres of annual lespedeza, 8 acres of cowpeas (following the oats). About 21 acres were in fallow land growing crabgrass, principally.

In complying with A. A. A. provisions the cotton acreage had already been reduced below that which normally prevailed on the farm. The new plan therefore provides for 55 acres of cotton and it calls for a reduction of corn to 27 acres and an increase in oats from 8 to 41 acres. The rest of the formerly cultivated land will go into perennial hay (17 acres of sericea lespedeza and 4 of kudzu).

TABLE 1.—*Comparison of land use before and after planning on the Hammett farm*

Item	Before	After	Net change
	Acres	*Acres*	*Acres*
Cultivated land	144	123	−21
Perennial hay	0	21	+21
Orchard	40	40	0
Woodland	119.2	109.2	−10
Pasture	10	20	+10
Wildlife	1.8	1.8	0
Total	315.0	315.0	0

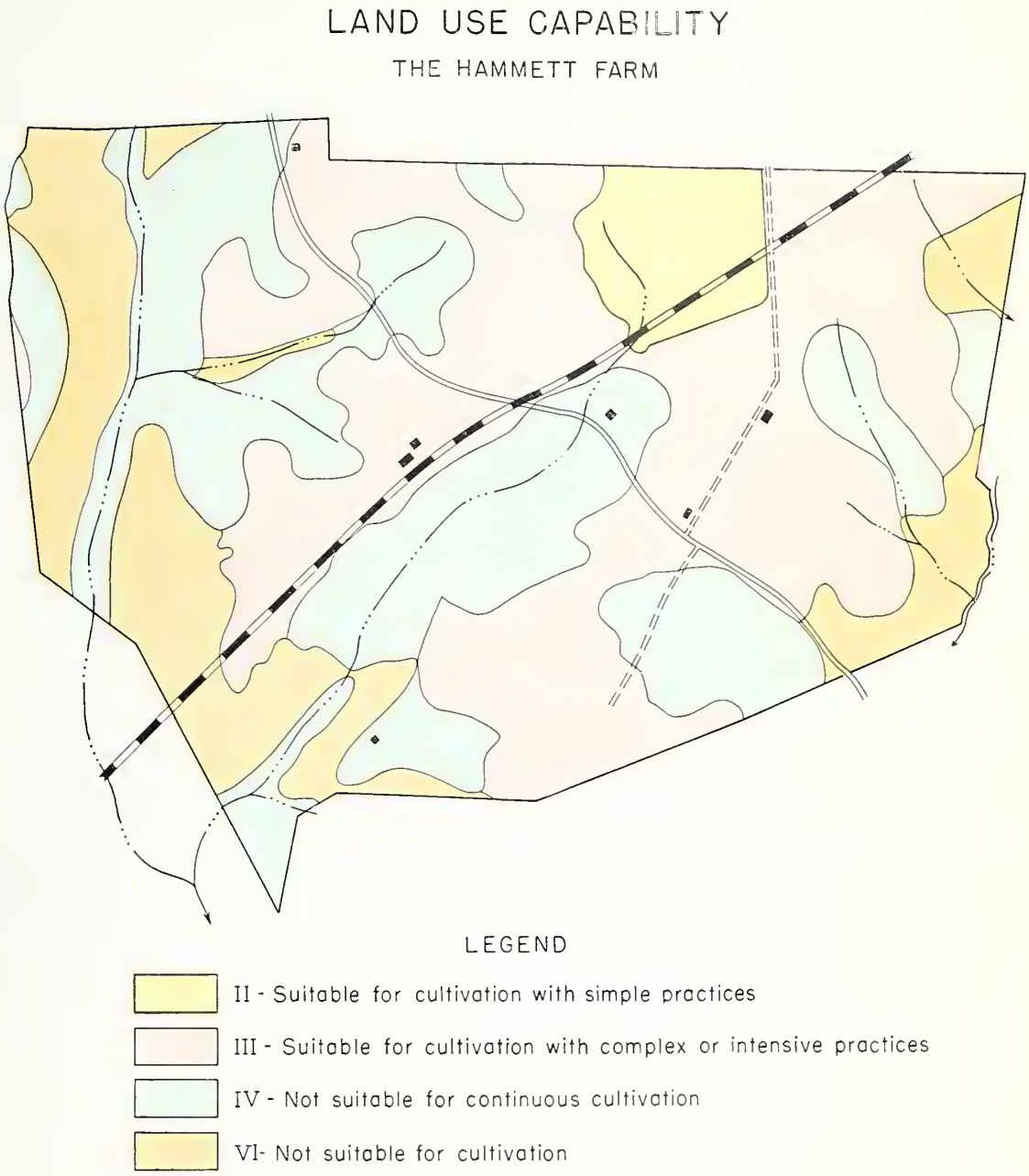

FIGURE 14.—This land use capability map of the Hammett farm indicates that care must be used if much of the land is kept in cultivation. On a few of the acres (class II) one can risk cultivation with simple practices.

The permanent pasture has been increased to 20 acres by grubbing brush and fencing a 10-acre bottom-land strip within the woodland area.

We can best discuss the conservation plan on this farm by referring to each field separately and by number.

Field No. 1 contains 39 acres and it lies west of South Carolina Highway No. 291 which roughly bisects the farm. The "capability" map (fig. 14) shows: (1) Some of the field can be cultivated using simple practices, (2) some of it can be cultivated safely only by using special care and precautions, and (3) a small part is not suitable for continuous cultivation.

For practical reasons the field cannot well be divided precisely according to the capability classes. The gullied spot of 2 acres, which is unfit for continuous cultivation, will be lashed down permanently with kudzu. And a small gullied strip adjacent to the west border will be used as a wildlife refuge. Here, sericea lespedeza will be planted. When the new highway was built through the farm an erodible bank was left on the edge of the cultivated field. Mr. Hammett plans to seed sericea in a 10-foot border adjacent to this road to prevent washing.

The main body of field No. 1 will be terraced (fig. 15). But perhaps even more significant is the improved rotation which is provided in the plan.

In the main the 3-year rotation consists of corn, cotton, and small grain. But there are additional safeguards. Cowpeas are planted in the corn and oats follow the cowpeas. The oats are turned under as a green-manure crop when the land is plowed for cotton. An annual lespedeza is seeded in the grain which follows the cotton. These crops will be planted in strips. The strips will be two-terrace intervals in width and are arranged so the strips will straddle the terrace ridges.

The cultivated fields, Nos. 3 and 11, will be handled under the same plan as that outlined for field No. 1.

In the 40-acre peach orchard Mr. Hammett will plant oats or rye each fall to be turned under as a green-manure crop. He has had some erosion where the orchard borders on the east and west road. A border strip of sericea will be planted along this road.

The pasture fields (Nos. 8 and 9) will be improved. One of the main water courses of the farm passes through field No. 9 which is to be developed for permanent pasture. Field No. 8 will be planted to kudzu in 1941. It will require approximately 5,000 plants, and 16 percent superphosphate fertilizer will be applied at the rate of 200 pounds per acre. This field was so poor and so badly eroded that it was uneconomical to try to get grass established. Though kudzu will require cultivation until it is established it is well suited to temporary grazing and is palatable and high in feed value.

Permanent pasture is provided in the Y-shaped field that is nearly surrounded with woods. Brush will be cut and some grubbing will be necessary so that the field can be plowed and harrowed in preparation for seeding (fig. 16). This will facilitate mowing which is necessary for proper maintenance. Phosphate and lime will be applied at seeding time (400 pounds, 16 percent superphosphate and 1 ton of lime per acre). Bermuda sod will be sprigged on the entire field and approximately 100 pounds of annual lespedeza will be seeded.

In order to use this area for pasture a fence is required so that animals can go back and forth from the buildings. The owner plans to build 530 rods of fence in 1941 so that the pasture can be used as soon as the new seeding is well established.

Fields numbered 2, 4, and 7 are now in woods and they will remain in permanent woodland. The combined woodland area of about 110 acres will adequately meet the farm needs for fuel, posts, and timber. Some timber will be available for sale (fig. 17). A wildlife border will be prepared between field No. 11 and the adjacent woods. Such a border will prevent

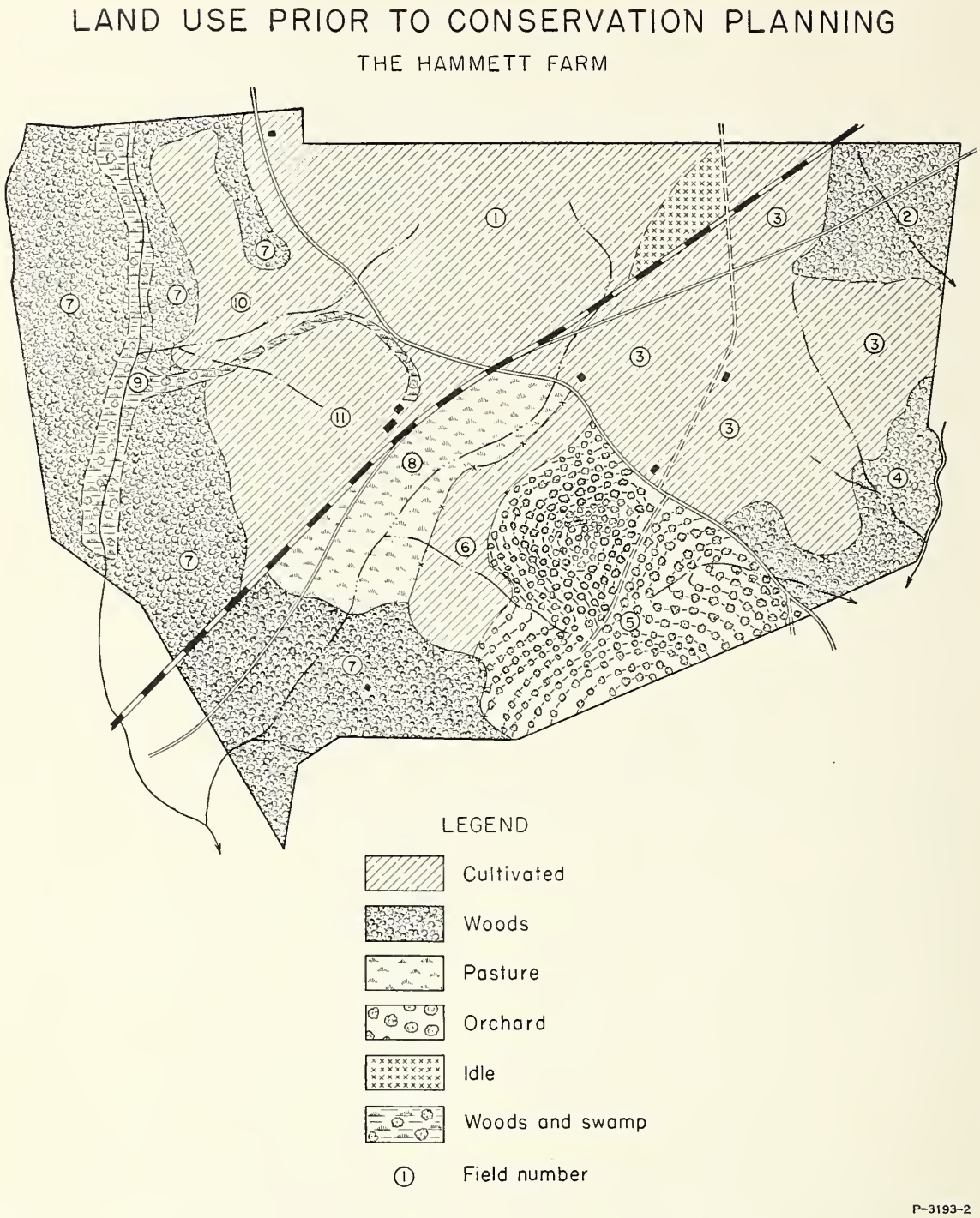

FIGURE 15.—Apart from the 40-acre peach orchard, most of the cultivated land grew cotton continuously prior to replanning. Much of this cotton was planted irrespective of the slopes.

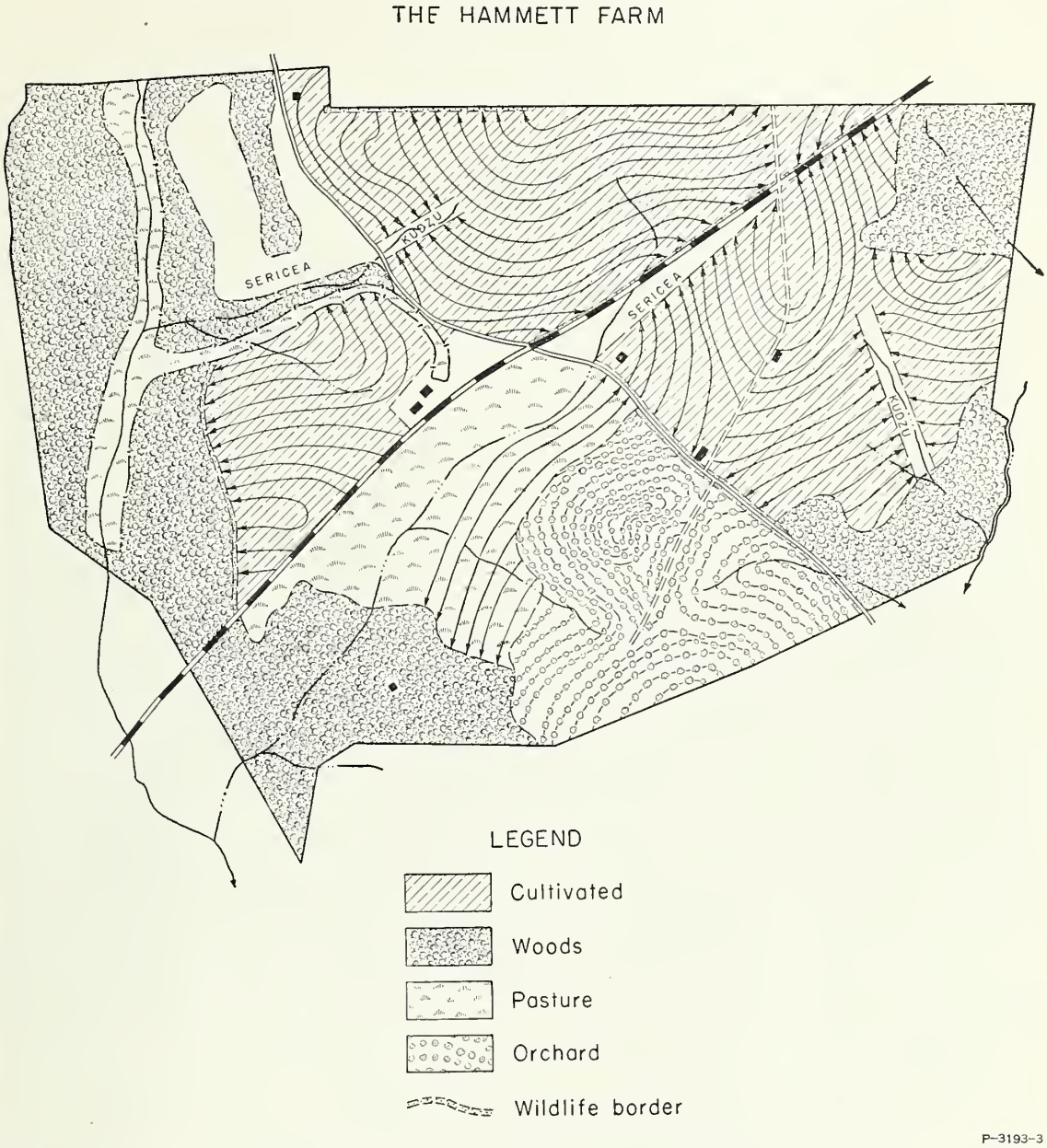

FIGURE 16.—After replanning, all of the cultivated land is farmed on the contour, and in a strip-cropping pattern. The map above shows the terrace lines for each of the cultivated fields. Note the gullied areas that have been planted to kudzu and the border areas of sericea.

erosion at the edges of the cultivated field and it will also provide food and cover for wildlife on land that produces sparse crops owing to the proximity of the woods and to erosion that has already taken place. Bush lespedeza will be planted in a 15-foot strip adjacent to the woods. These shrubs will become 8 to 12 feet high when mature. Between the shrubs and the cultivated land will be an additional 15-foot strip that will be planted to sericea lespedeza.

Before making a new plan for his farm, Hammett kept on the average about 6 head of horses and mules, 4 dairy cows, 2 young cattle, 150 chickens, and 15 hogs. When the new plan was considered he expressed a desire to feed about 20 beef cattle annually. He wants more manure for use in his peach orchard than the present number of animals will provide.

While the new plan provides only 20 acres of pasture it is estimated that there should be about a 50-percent increase in available grain. Corn, of course, will be reduced but the oats, on the basis of present yields, will be increased from about 280 bushels to a little over 1,400 bushels. The hay supply should also be increased by about 20 percent.

Normally the pasture acreage would be too small for the increased number of livestock.

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FIGURE 17.—A part of the Hammett farm income is derived from the woods. The owner saws his own lumber for farm needs and does some sawing for neighbors.

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FIGURE 18.—Cotton and peaches are the chief cash crops on the Hammett farm. In this view we see corn, cotton, and peaches growing on the contour.

But Hammett plans to stall-feed his beef cattle most of the time so that the manure can be spread in the peach orchard. By stall-feeding, the surplus grain and hay will be used to supplement the shortage of pasture.

The present plan, it will be noted, provides for no change in the acreage of the chief cash crops, peaches and cotton (fig. 18). But the soil resource upon which these crops are based should be more secure. When the terracing program has been completed; when the improved cropping system is fully established; and when the gullied areas have been lashed down with vegetation, then the soil and water losses should be reduced materially. With these improvements this farm gives promise of being permanent.

The Blau Farm

Lewis Blau and his son, Max, farm two adjoining sections of land near Booker in the Texas Panhandle. Their land is in Lipscomb County, which touches the Oklahoma boundary on the north and east.

A small portion of their land was broken from native sod in 1910. Between 1910 and 1918 they grew a comparatively small acreage of wheat, and some feed crops, but they relied primarily on livestock which in turn thrived on the native grasses. In 1918 the Blaus, like thousands of others, responded to World War wheat prices by breaking 300 acres of sod. They went into debt for machinery to handle the increased acreage.

When wheat prices collapsed after the World War the Blaus were forced to sell their holdings but they remained as tenants. They had a good year in 1926, for their wheat crop netted a little over $13,000. They bought the land back, promptly. The Blaus now speak of that year with mixed feelings. They were glad of an opportunity to reclaim the land but as Max says, "that year came near being the ruination of mankind." He means, of course, that many folks nurse the hope that such a year will soon

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FIGURE 19.—Max Blau points to one of the spots where, in 1929, "You could bury a horse * * * without digging."

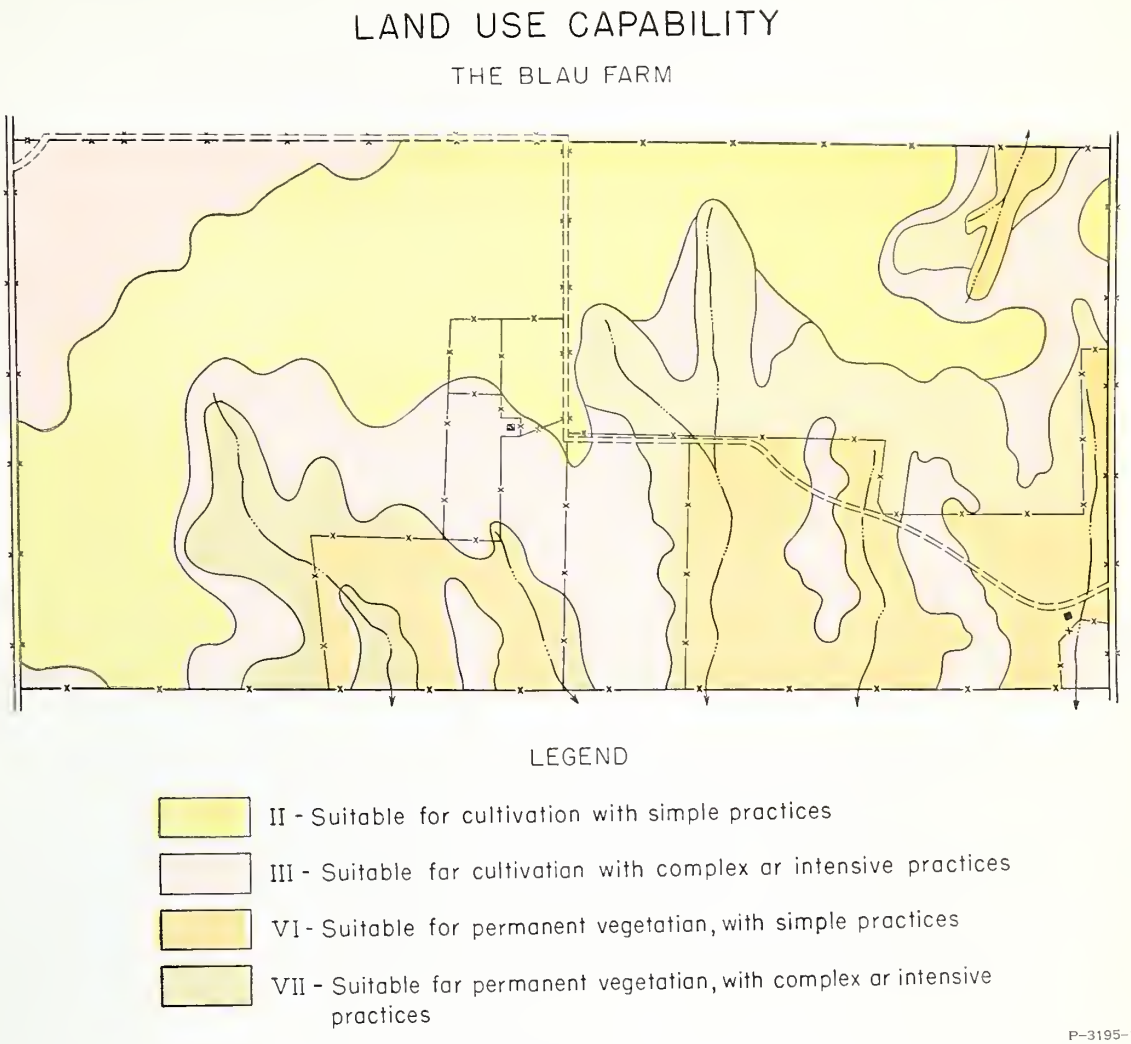

FIGURE 20.—This capability map permits one to determine the appropriate use of the 1,280 acres of land in the Blau farm.

come again and put them back on their feet, financially. While the Blaus continue to raise wheat as a cash crop they realize that the vagaries of the climate and prices do not warrant them in relying on wheat to the extent they did in 1926.

The Blau farm reveals little punishment by the wind. You see fewer hummocky fields and drifted fence rows than you do in many other wind-whipped areas in the southern Great Plains. Even so, as Max says, the soil really started to move around in 1935 and 1936.

Though Lipscomb County lies at the eastern edge of what newspapers call the Dust Bowl, water damage is far more severe than that by the wind. As early as 1929 water had etched deep gullies in the sloping cultivated land that lies in the northwest corner of the farm. Max said, "You could bury a horse most anywhere without digging" (fig. 19). In the fall of that year, 1929, Max visited his brother in Austin. On that drive he saw two or three terraced fields. In the following year the Blaus built their first terraces in the northwest field. Their county agent helped them to lay off the terrace lines. These terraces have been strengthened and improved during recent years and there is now no suggestion of severe soil washing. Yet, as Max says, "When you think of the sheet erosion we had before the gullies started you realize that something happens while you sleep."

When the Blaus started contour farming on that terraced field they noticed that it took less gas and oil than formerly when they farmed parallel with the farm boundary lines. They also noticed more weeds on the terraced land than they did on other areas that were cultivated up and down the slopes. This meant, they reasoned, that the terraced land conserved more moisture than land without terraces.

As you approach this farm from the north and drive south on the road that divides the two sections you will see that the land best suited for cultivation lies principally in the northern half of each section. The broken and more rolling grazing land lies to the south.

If you drive over the two sections you can plainly see more variations than are apparent in the first glimpse from the road. Some of the land now in cultivation should be retired to pasture and some of the land in pasture is suitable for cultivation. All of these significant variations are shown on the "capability map" (fig. 20), which permits one to visualize the whole farm.

In a general way the Blaus have put the main body of their land to its best use. However the use of the old square system of farming (figs. 21 and 22) left the pasture areas in a square or rectangular design, which did not harmonize with the topography of the land or put each acre to its best use. For example, the pasture in the west section was laid out in straight lines. On the north and west side of this pasture were 29.7 acres of gullied cultivated land that should have been retired to pasture. The old fence is to be removed and a new fence will be built on the contour when grass takes hold on the retired area. Similarly, just across the line in the east section is a 29-acre strip that is retired to pasture.

If you check the figures for the areas in cultivation, pasture, and other uses, before and after the farm was rearranged, you get the comparison shown in table 2.

TABLE 2.—*Showing the shift in land use on the Blau farm through conservation planning*

Item	Before	After	Net change
	Acres	*Acres*	*Acres*
Cultivated	950.9	832.0	−118.9
Pasture	297.5	407.1	+109.6
Windbreaks	0	9.3	+9.3
Roads, lots, etc	31.6	31.6	0
Total	1,280.0	1,280.0	0

When the plan is fully completed and in operation all of the 832 acres in cultivation will be terraced and farmed on the contour (fig. 23). The cropping plan to be followed will be a flexible system of wheat, grain sorghums, and fallow. The system is flexible in the sense that

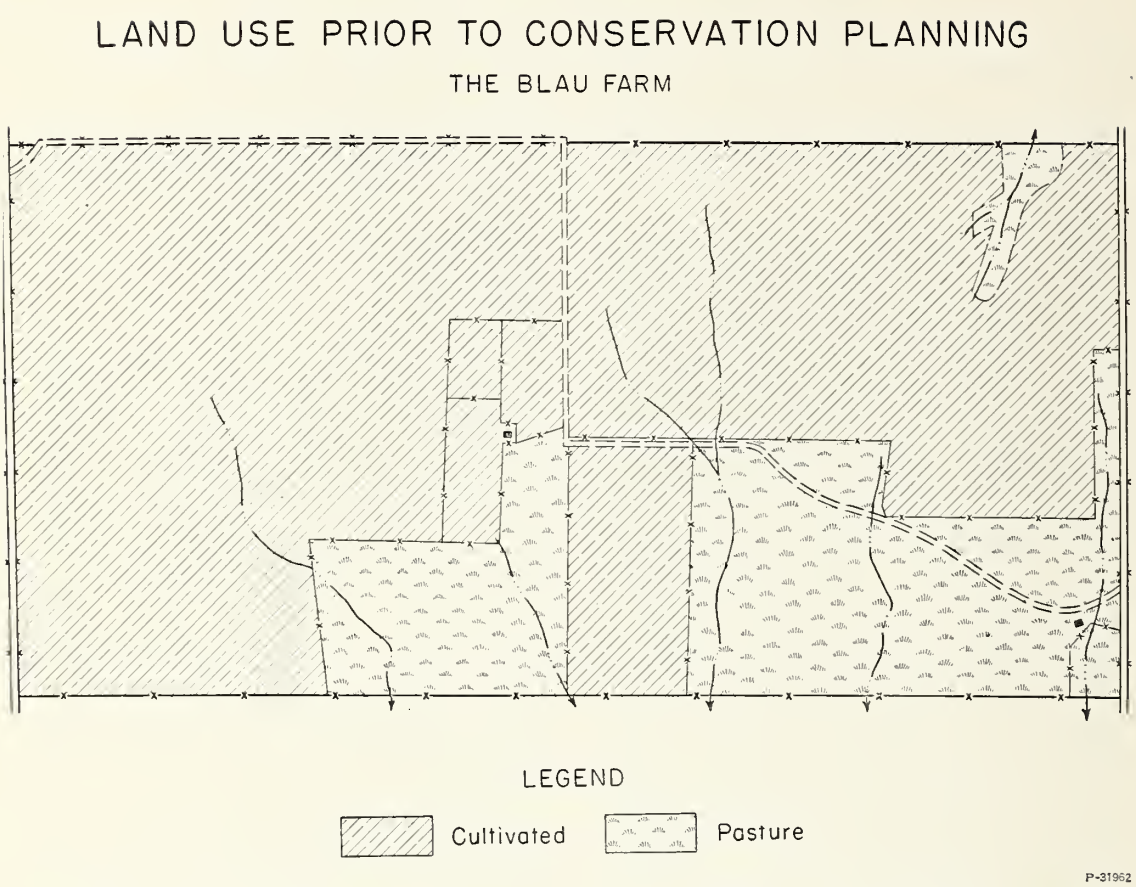

FIGURE 21.—In general the Blaus have put the main body of their land to its best use. Pasture fences, however, were placed in straight lines. This left some land in cultivation that is better adapted to pasture.

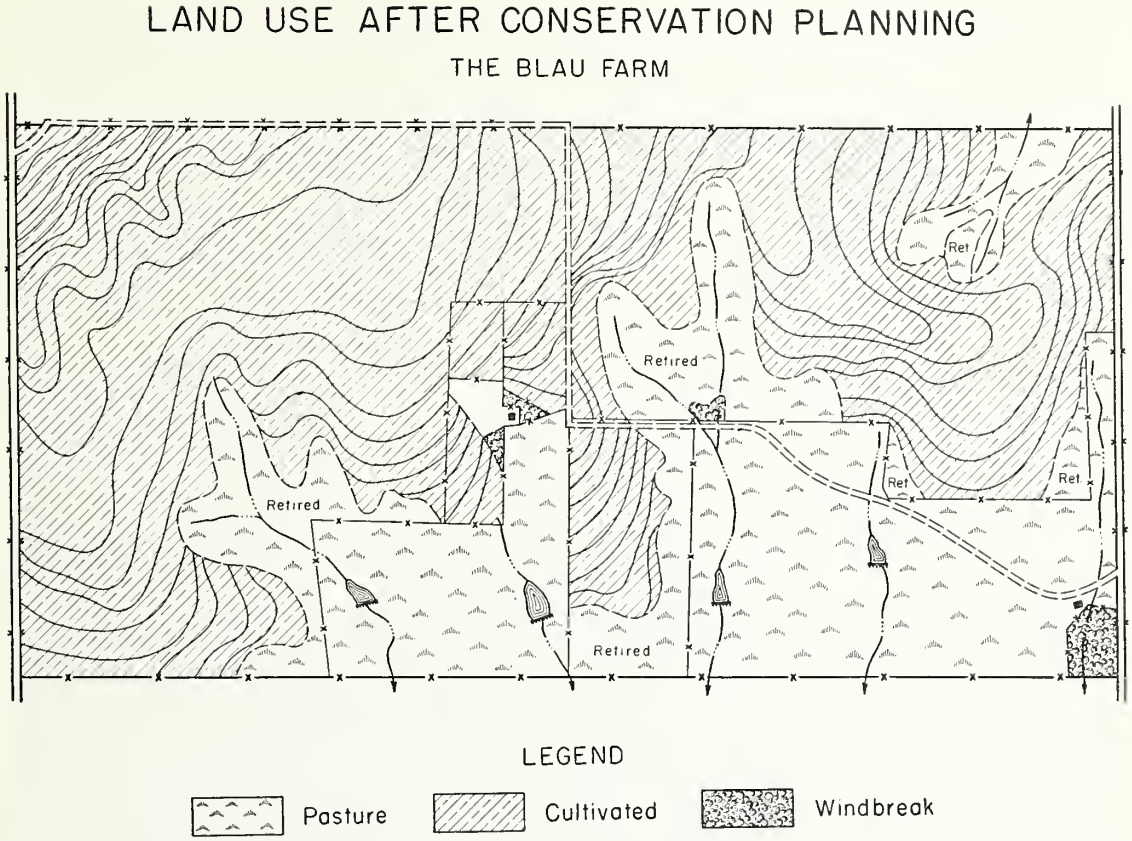

FIGURE 22.—The revised plan on the Blau farm calls for terraces, contour farming, and a flexible cropping system on the cultivated land. Some of the formerly cultivated land is retired to pasture. Stock water dams, a deferred and rotation system of grazing, and contour pasture furrows are the major improvements for the pasture land.

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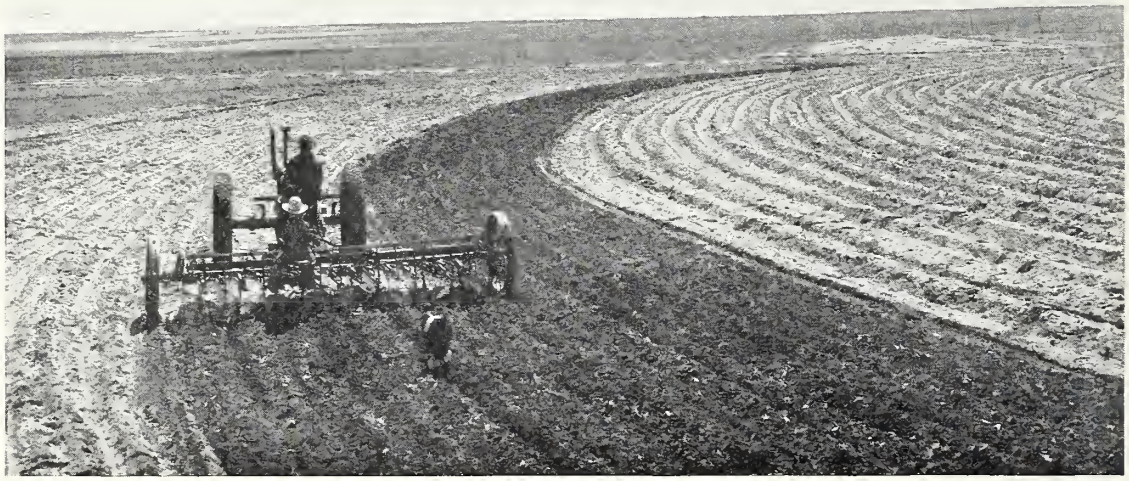
wheat will be sown only in those years when moisture and crop residue conditions are favorable. Under such conditions wheat production may be expanded to the maximum desired acreage. When conditions are unfavorable for wheat, a strip cropping or a solid planting of grain sorghums will be used.

Eventually and perhaps as early as 1941, practically all of the pasture land will be contour-furrowed to conserve moisture. At present only the original pasture land can be furrowed. The 109.6 acres of land that is now being retired to pasture will be furrowed when the new seeding has become established.

A good start has been made in the reseeding of retired land. The 29-acre strip in the east section grew forage sorghum in 1937. A stubble of approximately 6 inches was left on the ground. In April 1938 the strip was seeded with a mixture containing sweetclover, blue grama, western wheat, wild-rye, and dropseed. A shallow-type furrow drill was used. The maps will reveal other cultivated areas in this east section that are to be retired to grass.

The Blaus have agreed to follow a 5-year grazing plan (fig. 24). In general, the plan involves the principles of deferred and rotation grazing. For example: Beef cattle would graze in the 184-acre pasture through May, June, and July. Then the cattle would be moved to a Sudan grass field, where they would graze through August, September, and October. Around November 1 a part of the stock would be returned to the 184-acre pasture and left there until about January 1. The rest of the herd would be grazed on sorghum stubble during the same period.

The 94-acre pasture in the lower part of the west section will be used principally for yearlong grazing. It should easily provide sufficient pasture for the few work horses and dairy cows through the season.



TEX.-1398

FIGURE 23.—The Blaus will farm all of their cultivated land on the contour when the new plan is fully completed and in operation.

Isolated pasture areas, such as that in the northeast corner of the farm, will be grazed when stock are turned in on the adjacent fields that are in stubble or Sudan grass. Grazing of all cultivated fields will be limited to prevent wind erosion.

A stock water dam has been constructed in each of the four main water courses in the lower part of the farm. These dams will provide an adequate quantity of water in locations that will aid in the distribution of livestock over the range. They will also help to retard erosion damage from the heavy rains.

Windbreak plantings of trees are now growing in four different locations (fig. 25). Three of the four are located near the homesites for the protection of man and livestock against strong winds. The fourth is located at the fork of two draws in the east section. All of the plantings are placed in such a way that water from an adjoining area can be diverted to them.

After heavy rains Max Blau used to go down into his pasture and watch the muddy water "slosh" through the draw. Now since much of the cultivated land is terraced and since pasture furrows hold most of the water where it falls he notices that much less water gets into the main channel than formerly. And he also says that the water is practically clean in comparison with the water that passed through the draw before controls were established.

TEX.-1400

FIGURE 24.—The plan for the Blau farm calls for the use of deferred and rotation grazing. Note how grass has crept into and over the pasture furrows.

The first pasture furrows were made in the fall of 1937 on part of the field adjacent to this draw. A rain-gage record at the farm shows that about 19 inches of rain fell in 1938, and a little over 12 inches in 1939. Buffalo grass reponded almost immediately. By 1940 grass had crept down into the depression and up over the ridges of each furrow.

Time, of course, will reveal the value of the improvements on the Blau farm. This much is certain already; soil and water losses are reduced perceptibly. Under the flexible cropping system

TEX.-1397

FIGURE 25.—Trees are now growing on strategic sites to serve as windbreaks.

it is impossible to estimate the returns from crops for any 1 year. However, over a period of years the wheat acreage should average about 528 acres as compared with about 598 acres before the farm was rearranged and control measures were established. Allowing for an increase of a bushel and a half (7.5 bushels per acre before planning, 9 after) per acre on the 528 acres, the average production for the farm should be increased about 265 bushels. Allowing, also, for a slight increase in the yield of sorghums and barley, the estimated production of feed crops would be increased.

There should be a pronounced increase in the carrying capacity of the pastures. When grass is established on the several areas that have been retired from cultivation and when the improved management practices have had time to reveal results, it is estimated that the carrying capacity will be increased by a fourth or even more.

The Blaus now have the following livestock: 2 horses, 2 dairy cows, 31 beef cows, 1 bull, 12 hogs, 50 chickens, and 1 brood sow. If they get a fair break in weather they should have the option of either selling some of their feed crops and renting some pasture to neighbors or of increasing their own herd of livestock to consume the feed. If the weather is against them during the next few years, the reserve feed in their trench silo, along with sorghum forage and pasture, should make it possible for them to hold their conservative-sized herd of livestock and survive on the Plains.

The Hass Farm

George J. Hass, Houston, Minn., owns and operates one of the 320 farms (fig. 26) that lie within the Burns-Homer-Pleasant Soil Conservation District in the southeastern part of the State.

The purpose here is to direct attention to the plan for this specific farm. But first it is right and practical to stand off from the farm and briefly recall some of the significant agricultural episodes of the community as a whole.

Early settlers grew wheat extensively on these highlands that lie from 500 to 600 feet above the nearby Mississippi. By 1868 the thriving city of Winona was the fourth primary grain market in the United States. When wheat reached its peak in 1877 there was at least one feed mill on each of five creeks which make up the watershed for the district. But straight wheat farming for various reasons proved undependable and a more general type of agriculture was ushered in. Different kinds of grain were grown and livestock became more prominent. In more recent years increasing emphasis has been placed on the improvement of rotations, and dairy cattle now dominate the livestock picture on most farms. "More cows, more silos to feed them, then machines to milk them, and then more pasture to graze them," this, in general, was the cycle.

MINN.–1279

FIGURE 26.—An air view of the Hass farm. Note how slopes lead downward from the ridge into the pasture and woodland areas which almost encircle the cultivated portion of the farm.

Today most of these farms appear far more secure than do thousands of other farms in the Corn Belt, or in many other regions. A large majority of the farms are free of mortgage debt and usually not more than one-fifth are operated by tenants. Moreover, most of the tenants are related to the owners of the land.

Despite all this, soil troubles have become more acute in recent years, and as in most farming areas, it is sometimes difficult to distinguish between cause and effect. For one thing, red clover failures have been common in late years. And when the seeding failed, most farmers put the field back in corn. As a result, an intertilled crop appeared twice in a 4-year rotation when it was intended to be used only once.

These clover failures are also an indirect cause of pasture depletion. When clover failed there was always the tendency, and frequently the necessity, of pasturing too early in the spring and too late in the fall because of a shortage of hay.

Soil surveyors in mapping the area were not surprised to find gullies either on the bare blufflike slopes that ranged between 30 and 75 percent or the steep portions of the ridge land. But they also found gullies eating their way up and into the comparatively level cultivated areas on the ridge tops. Still more serious was the widespread havoc of sheet erosion. All of the cultivated land was affected by sheet wash and fully half of it had lost from one-fourth to three-fourths of the topsoil.

As elsewhere, farmers were tardy in recognizing the losses from sheet erosion. But they did notice gullies. Each year at threshing time when neighbors went from farm to farm, they found gullies in some fields where they never expected to see them.

In 1939, George J. Hass planned an erosion-control program for his farm in cooperation with the supervisors of the Burns-Homer-Pleasant district. That year, he and his son, Lester, planted several strips of corn and grain on the contour. They noticed some tangible results. In April 1940, Lester said: "Our fields that we had stripped last year held every drop of rain that fell during the summer." Lester also noticed that he could not cultivate the corn on the contour as soon after a rain as he could

MINN.-1284

FIGURE 27.—Lester Hass found that he could not cultivate corn on the contour as soon after a rain as he could that which was planted in the conventional way.

that which was planted in the conventional way (fig. 27). The extra moisture saved was also reflected in the yield of corn in the fall. Convinced by these early results, Lester and his father made a conservation plan for a recently acquired 180-acre farm that lies adjacent to the land here considered.

Had you visited this farm in 1938 you would have driven down a straight farm road to the homestead which stands in the approximate middle of the farm (figs. 28, 29, 30). To the

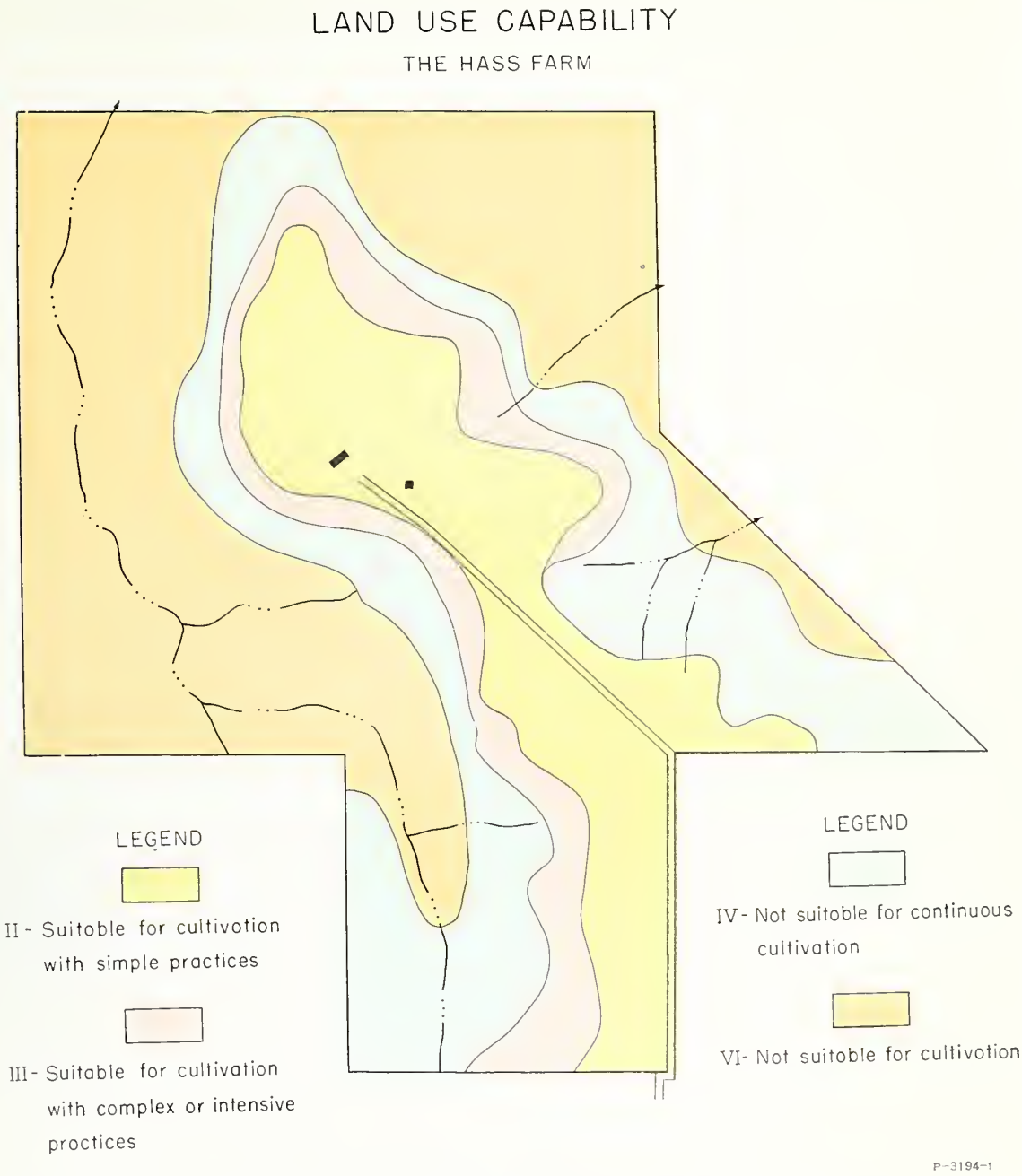


FIGURE 28.—The cultivated portion of the Hass farm lies on a broad ridge that extends midway into the farm. Pasture and trees occupy the steeper slopes which almost encircle the farm.

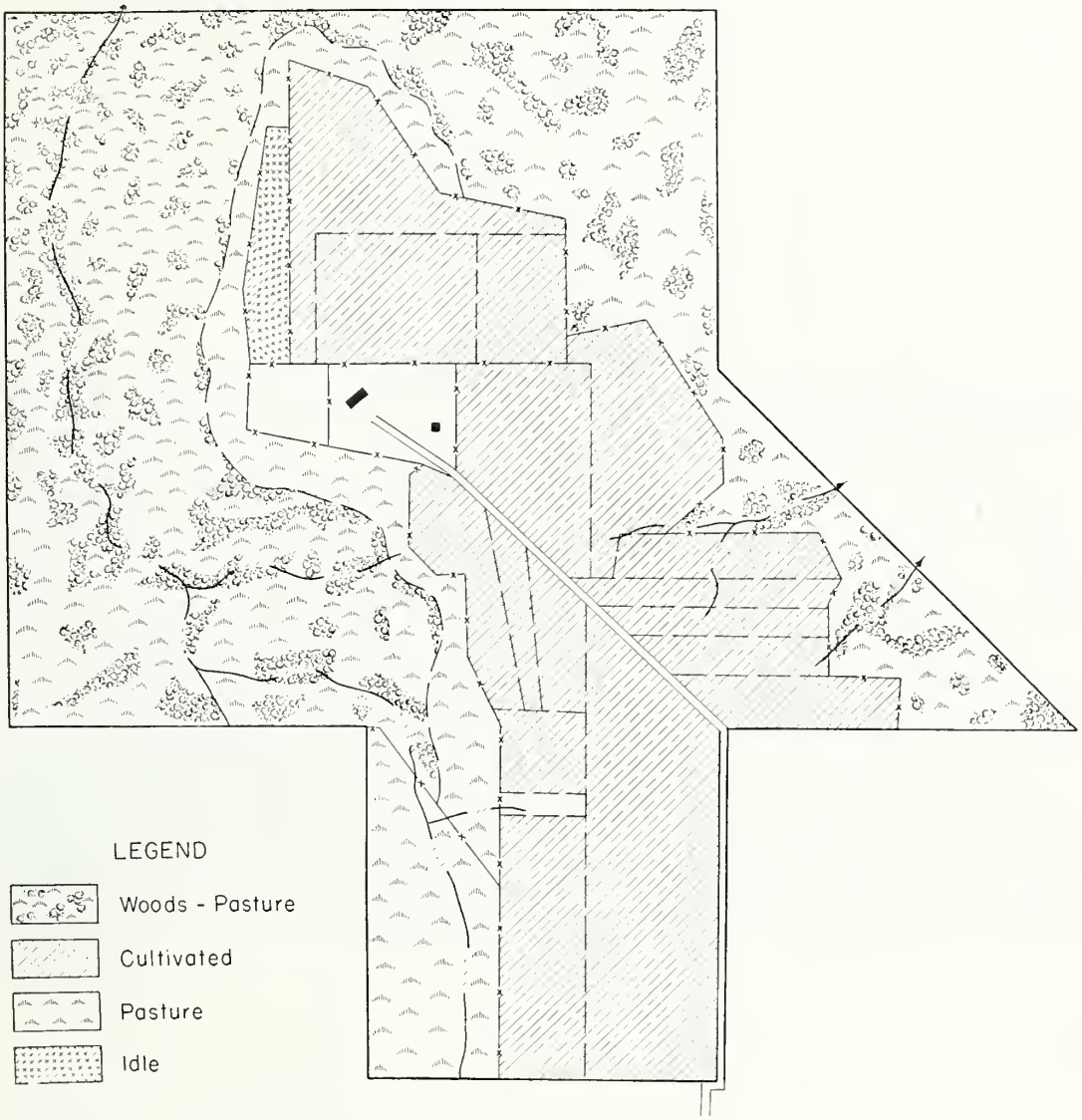


FIGURE 29.—The sloping land on this farm was wisely left in natural vegetation. Field boundaries and fences, however, were not on the contour. This means that much of the land has been cultivated irrespective of the slopes.

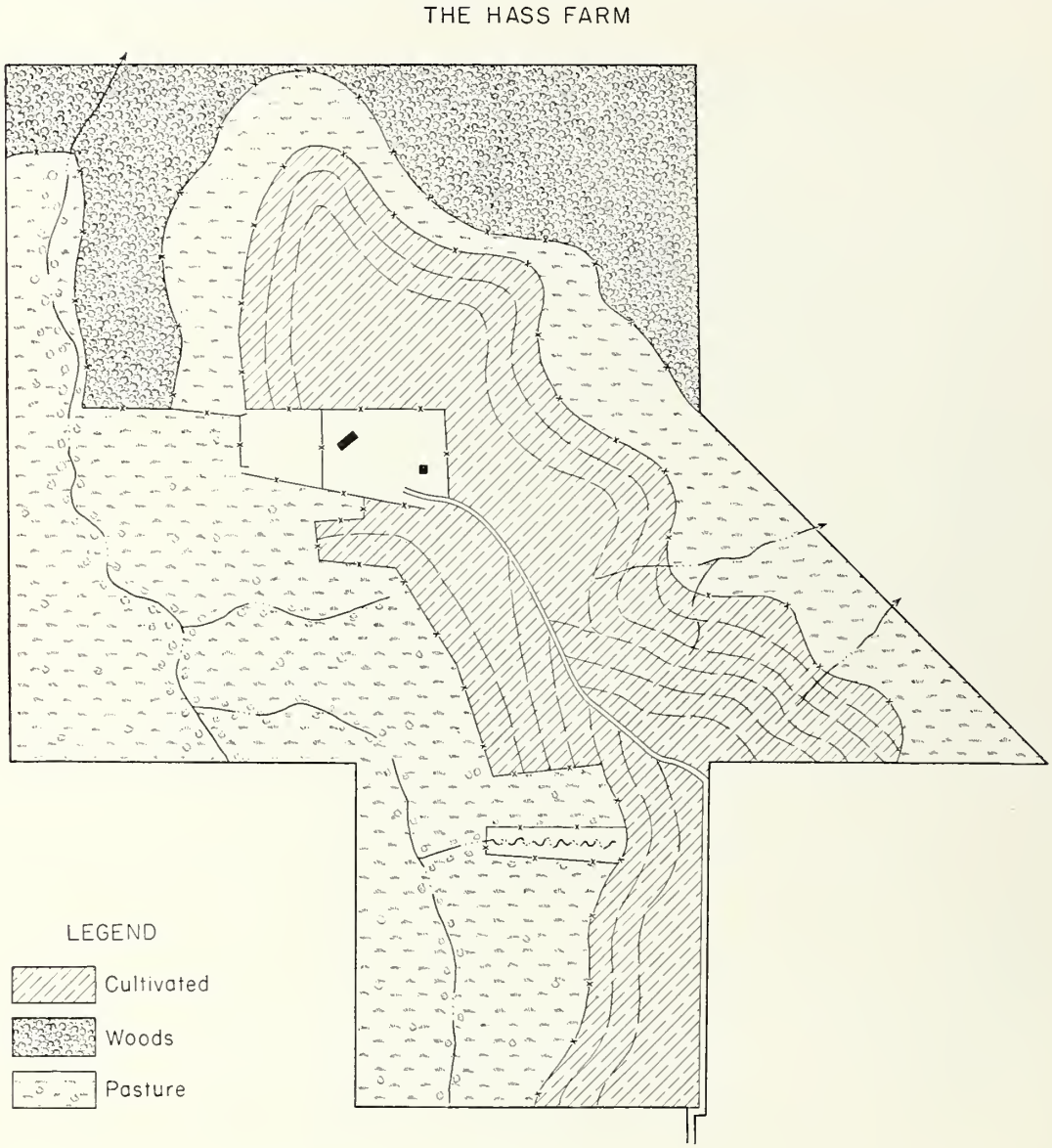


FIGURE 30.—The completed conservation plan for the Hass farm is shown above. Note how the strip-crop pattern fits naturally into the farm lay-out. Note also the contour lane that follows the ridge summit from the highway to the homestead in the center of the farm.

right and left of the road you would have seen small fields of corn, oats, alfalfa, timothy, and clover. All of the fields, though of various sizes and shapes, would have had straight boundaries and each would have been farmed irrespective of topography and flow lines. On top of the ridge you would probably see little apparent damage from soil washing. But if you had stepped down across the fields in either direction you would have seen small gullies leading off to the main drainageways into the pasture and woodland which almost encircle the cultivated area on the farm. Most of these gullies could still be crossed with machinery, but you notice several in the lower 40 acres that have become too deep to cross.

If you returned to the farm in 1940 you would see changes. Assuming that the plan adopted by Hass continucs to develop on schedule, you would see still greater changes if you could return, say in 1943 or 1944. You would travel on a road that was relocated to conform with the stripcropping system. You would note bands of crops, hugging the slopes on either side. Beyond the cultivated strips and down the slope you would see a pasture fence on the contour (fig. 31).

MINN.—128

FIGURE 31.—This new fence, built on the contour, separates the pasture from the cropland. Cattle are now grazing on the area that was once badly eroded.

When you arrived at the homestead you would see bands of crops leading off to the south. If you followed them with your eye you would be carried almost back to the end of the farm road where you entered the farm. Down the slope and below these strips of crops, you would find a pasture fence on the contour. The gullied area you saw in the lower forty in 1938 has been fenced, a few check dams have been installed, and the whole fenced area, of a little over 1½ acres, will be planted to trees and shrubs.

TABLE 3.—*Proposed practices for each of the land capability classes on the Hass farm*

Land-capability class[1]	Land use	Rotations[2]	Supporting conservation practices	Soil treatment
II (yellow)[3]	Cropland	Corn, small grain, hay, hay, hay	No practices	Lime-manure.[4]
		Corn, small grain, hay, hay	Contour cultivation	Do.
		Corn, small grain, hay, corn, small grain (sweet-clover).	Contour strips 75′–125′	
		Corn, small grain, hay	Terraces	Do.
III (red)[3]	Pasture, cropland		No practices	Do.
		Corn, small grain, hay, hay, hay, hay	Contour cultivation	Do.
		Corn, small grain, hay, hay	Contour strips 60′–100′	Do.
		Corn, small grain, small grain, hay, hay	Terraces	
IV (blue)[3]	Pasture, cropland		No practices	Do.
		Small grain, hay, hay, hay	Contour cultivation	Do.
		Small grain, small grain, hay, hay, hay	Contour strips 50′–60′	Do.
		Corn, small grain, hay, hay, hay	Terraces	Do.
VI (orange)[3]	Pasture, woodland		Controlled grazing	Do.
			Protected	

[1] The development of areas for wildlife such as gullies, streambanks, and wasteland, is recommended for all land classes.
[2] Barnyard manure is to be used at least once in each rotation. Lime is to be used on each field to be seeded to alfalfa or sweetclover when test shows that it is needed. Phosphate fertilizer should be used if a trial on a part of a field shows it to be profitable. All permanent pasture should be properly managed.
[3] Color distinguishing class area on the map.
[4] When needed.

By consulting table 3, you will see how the land is to be used in accordance with its use capability. You will also note that a choice can be made among several rotations, and that the supporting conservation practices depend upon the rotation selected.

Take, for example, the cropland shown in class II. Hass may select a rotation of corn, grain, 3 years of hay; corn, grain, 2 years of hay; corn, grain, 1 year of hay; and corn, grain (sweet-clover), corn, grain, hay. If he selected the first rotation (corn, grain, 3 years of hay) there would probably be no need for special conservation practices. On the other hand, if he selected the last rotation which provides for corn 2 years out of 5, then he would probably need terraces and contour strips that did not exceed 125 feet in width. In other words, as the rotation becomes more intensive the need for conservation practices increases. This principle is borne out in the recommendations for each of the land-capability classes.

Formerly Hass gave his livestock the run of the entire area which is labeled class VI on the land-capability map. It contains both woods and pasture. Neither trees nor grass do well in a "woods-pasture" hence the plan calls for a fence to exclude livestock from a portion of the area. Hass plans to do selective cutting in the fenced woodland and he will also cut some trees, when needed, from the more level portions of the permanent pasture.

If you set down the acreages devoted to different uses on the Hass farm in two columns—one before the farm was planned and one after—you get the comparison shown in table 4.

TABLE 4.—*Comparison of land use before and after conservation planning*

Item	Before	After	Net change
	Acres	*Acres*	*Acres*
Cultivated	76	53	−23
Permanent hay	17	22	+ 5
Permanent pasture	27	48	+21
Woods-pasture	91	51	−40
Woods-livestock excluded	0	40	+40
Farmsteads, roads	6	6	0
Idle	3	0	−3
Total	220	220	0

At the time the plan was made Mr. Hass kept 2 horses, 19 dairy cows, 16 young stock, 18 pigs, and 60 chickens. He plans to increase the dairy cows by 5 head and the chicken flock by 65. Otherwise, the livestock numbers will remain practically the same. A general-purpose tractor is used on the farm, thus making it possible to do the necessary work with 2 horses (fig. 32).

Allowing for a slight increase in yields the farm should easily carry the increased number of livestock. The yearly yield of concentrates (corn and small grains) should be about 1,040

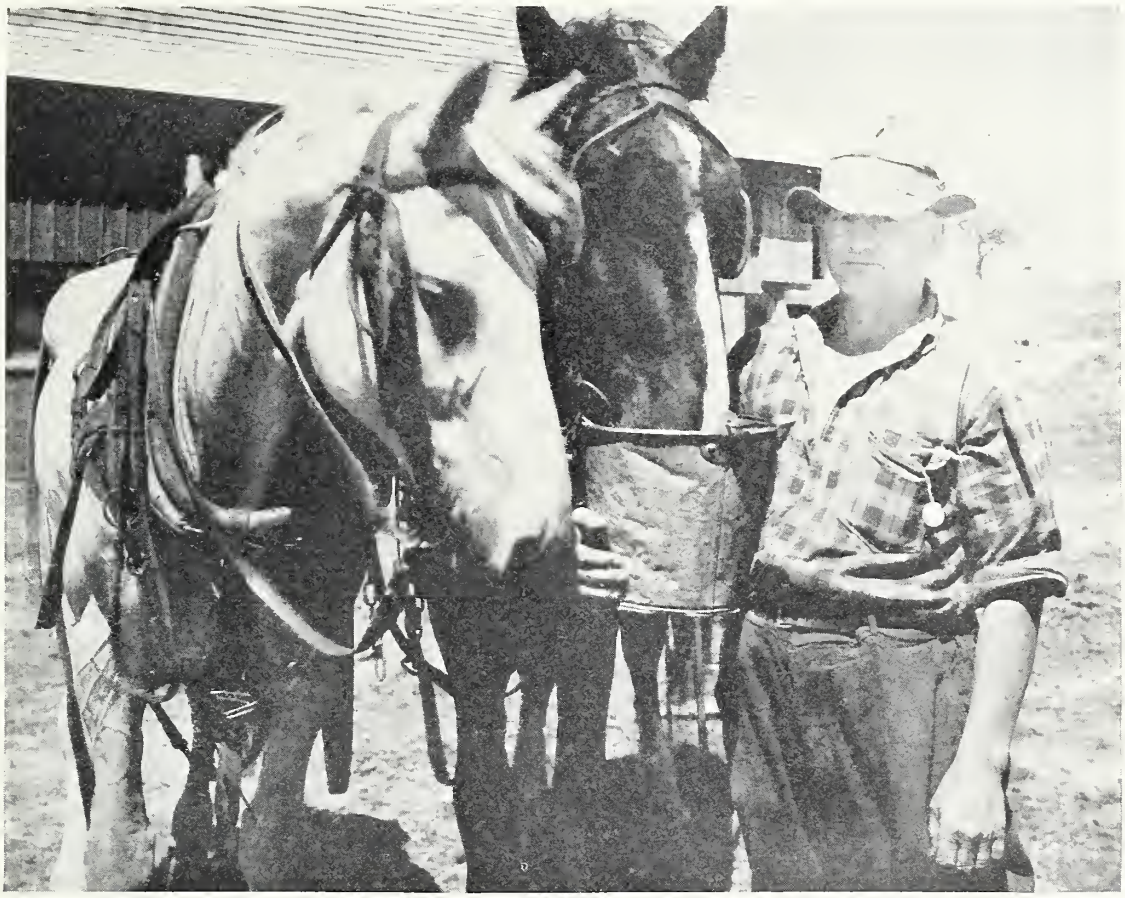


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FIGURE 32.—Two horses and a tractor provide the power to farm the 220 acres on the Hass farm.

bushels as compared with about 895 bushels under the original plan. The roughage is estimated to be about 157 tons as compared with 133, the estimated tonnage under the old plan. The carrying capacity of the pasture is estimated to be about the same under the new plan as under the old (6,260 pasture-days under the old plan; 6,300 under the new).

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